TWO ESSAYS ON THE ROLE OF NONBANK FINANCIAL INSTITUTIONS AND FIRMS IN THE MONETARY TRANSMISSION MECHANISMS

by

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STATEMENT OF DISSERTATION APPROVAL

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ABSTRACT

In my first essay, I theoretically and quantitatively examine the role of nonbank financial institutions in the monetary transmission mechanisms. First, in accordance with Bernanke's proposal (2007), I theoretically explain the effect of restrictive monetary policy on the behavior of both banks and nonbank financial intermediaries through their balance sheet conditions, which is a medium for the two kinds of lenders to shrink their loan supply. Second, if this theoretical explanation is correct, empirically we should expect the *net worth* and the *intermediated loans* of both kinds of lending institutions to fall in response to a tight monetary shock. Employing the traditional OLS and the VAR methodology, I find that nonbank financial institutions respond by shrinking their net worth, and they subsequently reduce their loans in the same ways banks do. This evidence suggests that nonbank financial institutions may play an important role in amplifying the effect of monetary policy on output, providing some explanation of the existing puzzles.

In my second essay, I provide more evidence on the behavior of small and large firms, employing the Flow of Funds data, the QFR data and other sources. The empirical test to examine behavior of small and large firms is conducted in two ways: (1) by different episodes, tight monetary policy episodes and business cycles episodes and (2) by different time periods, Pre-1990 periods and Post-1990 periods.

First, I find that a monetary shock and an NBER recession shock *differently* affect firms' short-term financing behavior. During recent periods, after a contractionary monetary shock, large firms *increase* their short-term debt more than small firms, whereas after an NBER recession shock, large firms *decrease* most balance sheet variables (including short-term debt) more than small firms. These findings suggest that small firms are more credit-constrained after a monetary policy shock, whereas large firms are more credit-constrained after an NBER recession shock. Second, I find that, after a contractionary monetary shock, during earlier periods, large firms *decrease* their short-term debt *less* than small firms, whereas during recent periods, large firms *increase more* than small firms. Although these findings appear to be contradictory, they are consistent in that small firms have continued to be more credit-constrained than large firms after contractionary monetary policy—at the time when demand for loans increases.

For my beloved parents and sisters

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CHAPTER 1

INTRODUCTION

Most economists would agree that monetary policy influences the real economy in the short run. Yet, they would disagree on precisely how monetary policy influences the real economy (see Bernanke & Blinder 1992; Christiano, Eichenbaum, & Evans 1996a, 1996b; Romer & Romer, 1989, for empirical evidence). Such different ways of how monetary policy influences aggregate demand and output is referred to as monetary transmission mechanisms. According to the conventional interest rate channel, the actions of monetary authority influence consumption and investment spending through changes in *interest rates*, therefore ultimately affecting the real economic activity. In this interest rate channel, the effectiveness of monetary policy depends on interest-rate-sensitive components of aggregate expenditure. However, empirical studies have faced enormous difficulty in identifying the *quantitatively strong* effect of interest rates on real variables, such as aggregate output and employment, in terms of purportedly interest-rate-sensitive components of aggregate expenditure[1] (see Friedman, 1990; Shapiro, Blanchard, & Lovell, 1986, for such difficulty in empirical studies).

The shortcomings of the conventional approach led a number of economists to search for other complementary explanations, one of which is known as the credit

[1] In other words, the estimated macroeconomic responses to policy induced interest rate changes are substantially larger than those inferred by conventional estimates of the interest rate sensitivity of consumption and investment.

channel of monetary policy. It puts emphasis on the role of credit market imperfections. In a situation where borrowers have more information about the quality of their projects than do lenders, such asymmetric information can trigger a premium in the cost of all forms of external finance over the cost of internal funds. This premium, known as an external finance premium, compensates lenders for the costs of mitigating the problems of moral hazard and adverse selection—e.g., the costs incurred in monitoring borrowers and a lemon premium that results from asymmetric information problems. According to the credit channel thesis, the impact of monetary policy on interest rates is magnified by endogenous changes in the external finance premium. The external finance premium to borrowers depends inversely on their financial conditions, measured in terms of indicators such as net worth and liquidity. For example, a borrower who has a stronger financial condition faces a lower external finance premium because the stronger financial condition mitigates the borrower's potential conflict of interest with a lender. As a result, endogenous changes in borrowers' financial conditions may increase the persistence and amplitude of business cycles and make stronger the influence of monetary policy. The credit channel therefore suggests that monetary policy can influence the cost and availability of credit *by more* than implied by the conventional movement in the interest rate channel alone.[2]

How do monetary policy actions affect the external finance premium in the credit channel? Bernanke and Gertler (1995) explain two possible effects: the balance sheet channel and the bank lending channel. First, according to the balance sheet channel, monetary policy can influence the external finance premium of borrowers (especially

[2] The credit channel of monetary policy is a magnification effect that works in tandem with the interest rate channel—rather than a distinctive and independent alternative to the interest rate channel.

small firms) by changing their balance sheet conditions (Bernanke & Gertler 1995; Gertler & Gilchrist 1991, 1993, 1994). For example, contractionary monetary policy that increases interest rates deteriorates borrowers' balance sheet conditions because an increase in interest rates raises their debt services and drops the value of their collateralizable assets. The weakening of borrowers' financial conditions increases the external finance premium, thereby reducing borrowers' ability to access credit. Second, according to the bank lending channel, monetary policy can influence the external finance premium of borrowers (especially small firms) by shifting the supply of bank loans away from small firms. For example, contractionary monetary policy that drains reserve-backed deposits makes some banks unable to raise nondeposit source of funds to continue their lending. If small firms are shut off from bank loans and are forced to find a new lender, they must incur some costs (i.e., an increase in the external finance premium) in establishing new credit relationships (Bernanke & Gertler, 1995).[3] Through either channel, contractionary monetary policy increases the external finance premium of *small* firms who are subject to capital market imperfections. The effect of the monetary policy action is amplified by endogenous changes in the external finance premium.

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[3] The example shown here illustrates one way of operating the bank lending channel; tight monetary policy influences the supply of bank loans by changing the external finance premium of *nonfinancial firms*. However, tight monetary policy can also influence the supply of bank loans by weakening the balance sheet conditions of *financial firms*—and thus by changing the external finance premium of *financial firms*. Such a way of operating the bank lending channel is shared by many other papers. Because banks must borrow uninsured funds in order to lend, they must pay the external finance premium just as ordinary firms do.

As banks' balance sheet conditions become weak after contractionary monetary policy, banks must pay the higher external finance premium to continue lending, thus being forced to reduce their loan supply. In this case, the bank lending channel is the balance sheet channel as applied to the operations of banks. The bank lending channel essentially operates through banks' balance sheet quality that results from either changes in bank reserves or changes in bank equity after monetary tightening (See Bernanke & Blinder 1988; Kashyap & Stein, 1995, 2000; Stein, 1998, for bank reserves and see Kishan & Opiela, 2000, 2006; Meh & Moran, 2004; Van den Heuvel, 2002, 2007, for bank equity)

My research is motivated by the unsatisfactory explanation of the conventional view of monetary transmission mechanisms. In my dissertation, I therefore examine the behaviors of *lenders* and the behaviors of *borrowers* more closely to find possible explanations for the empirical difficulty we have faced. On the lenders' side, I consider the behavior of nonbank financial institutions—which previous studies fail to take into account in the mechanism of monetary policy—as one possible contributing factor to the sharp decline in output following tight monetary policy. Nonbank financial institutions (NBFIs hereafter), which also provide credit to borrowers in credit markets, may cut back on their credit to borrowers in a similar manner to banks if tight monetary policy affects the behavior of both kinds of lending institutions in a similar way.

Chapter 2, entitled "The Role of Nonbank Financial Institutions in the Monetary Transmission Mechanism: Theory and Evidence," theoretically and quantitatively examines the role of NBFIs in the transmission of monetary policy. First, as suggested by Bernanke (2007), I theoretically explain how contractionary monetary policy affects the quantity of loans of banks and NBFIs through changes in their balance sheet conditions, particularly net worth. Second, I empirically test whether the *net worth* and the *intermediated loans* of banks and NBFIs fall in response to a contractionary monetary policy shock. Employing the OLS and the VAR methodology, I find that NBFIs respond by shrinking their net worth, and they subsequently reduce their loans in the same way as banks. This evidence suggests that the presence of nonbank lending effect may make the existing lending channel stronger. It thus may provide a possible explanation about the empirical difficulty that we have encountered in the monetary transmission mechanism.

I also consider the behavior of borrowers—which the earlier studies do take into account in the monetary transmission mechanism—as a contributing factor that leads to the substantial reduction of production because borrowers are likely to face higher external finance premium after tightening monetary policy. An interesting question is which firm group (small or large firms) is more adversely affected when credit becomes less available and more expensive. Earlier research finds that *small* firms are more adversely affected than large firms after contractionary monetary policy because small firms are subject to credit market imperfections. In recent studies, however, new evidence has shown that, in contrast to the earlier findings, *large* firms are more adversely affected than small firms in relation to employment, sales, and short-term debt during recent recessions of the 1990, 2001, and 2007. So far, economic scholars have found mixed empirical results, depending on their different dataset and different types of episodes. The questions arise from such mixed results: Why do earlier findings show different results from recent findings? Do such different results arise from the fact that different scholars use *different episodes* in their historical event study? (i.e., tight monetary policy episodes versus business cycles episodes) Do such different results arise from the fact that different scholars use *different time periods* in their dataset? (i.e., Pre-1990 periods versus Post-1990 periods)

Chapter 3, entitled "The Behavior of Small and Large Firms During Business Cycle Episodes and During Monetary Policy Episodes: A Comparison of Earlier and Recent Periods," sheds light on the three questions raised above. I provide more evidence on the behavior of small and large firms, employing the Flow of Fund data, the QFR data and other sources. I conduct the empirical tests in two ways: (1) different episodes, tight

monetary policy episodes and business cycles episodes, and (2) different time periods, Pre-1990 periods and Post-1990 periods. First, examining the behavior of small and large firms by different episodes, I find that a monetary policy shock and an NBER recession shock *differently* affect firms' short-term financing behavior. After a contractionary monetary policy shock, large firms *increase* their short-term debt substantially more than small firms, whereas after an NBER recession shock, large firms *decrease* most of balance sheet variables (including short-term debt) significantly more than small firms—especially during recent periods. These findings suggest that small firms are more credit-constrained after a monetary policy shock, whereas large firms are more credit-constrained after an NBER recession shock. Second, examining the behavior of small and large firms by different periods, I find that, after a contractionary monetary shock, during earlier periods, large firms *decrease* their short-term debt *less* than small firms, whereas during recent periods, large firms *increase more* than small firms. Although these findings seem to be contradictory, they are consistent in that small firms have continued to be more credit-constrained than large firms after *contractionary* monetary policy—at the time when demand for loans increases.

Taken as a whole, my dissertation provides some possible answers for the puzzles existing in the effect of the monetary policy; it also sheds light on the transmission mechanisms between monetary policy shocks and NBER recession shocks. In my first essay, the main finding is that NBFIs shrink the quantity of loans in a way similar to banks after contractionary monetary policy. The evidence suggests that NBFIs play a key role in increasing the strength of the lending channel when we consider NBFIs as

well as banks in the monetary transmission mechanism. Incorporating NBFIs into the framework of monetary policy may provide a reasonable explanation for the current empirical problem. In my second essay, the important finding is that a monetary policy shock affects the short-term debt of (small and large) firms differently than an NBER recession shock. The evidence suggests that, after *an NBER recession shock*, the financial accelerator mechanism may operate through *large* firms, which are more financially constrained due to their higher leverage ratio at a cyclical peak—particularly during recent periods. Moreover, consistent with the previous studies, after *a monetary policy shock*, the accelerator mechanism may continuously operate through *small* firms, which face greater financial constraints due to the lack of access to credit lines and relatively less strong financial conditions at a time of a monetary policy shock.

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CHAPTER 2

THE ROLE OF NONBANK FINANCIAL INSTITUTIONS IN THE MONETARY TRANSMISSION MECHANSIM: THEORY AND EVIDENCE

2.1 Introduction

Over 50 years from 1959 to 2009, the market share of assets held by banks had significantly fallen from 55 to 27%, whereas the market share of assets held by nonbank financial institutions (hereafter, NBFIs) had dramatically increased from 45 to 73%.[1, 2] In spite of the increased important role of NBFIs, NBFIs have received little emphasis and are not treated at all in the transmission mechanism of monetary policy. The main reason for such omission is that *only* banks, which are subject to reserve requirements and thus are under the direct control of monetary policy, have been in the center of debates about whether they are special types of intermediaries, as a theory of the bank lending channel would assert. According to the bank lending channel, banks are special because they are well-suited to deal with some classes of borrowers (especially small businesses) who pose severe asymmetric information problems in credit markets (see

[1] The U.S. banking industry has declined and has lost its market share to NBFIs. See, for example, Edwards (1993), Edwards and Mishkin (1995), and Cole, Wolken, and Woodburn (1996).

[2] In this paper, a "bank" is defined as a *depository* institution such as a commercial bank, a credit union, or a saving institution. Also, a "nonbank financial institution" is defined as a *nondepository* institution such as an insurance company, a finance company, a mortgage company, a brokerage company, or a leasing company.

Bernanke & Blinder, 1988; Kashyap & Stein, 1994; Kashyap, Stein, & Wilcox, 1993, for the bank lending channel).

However, a number of researches suggest that, just like banks, NBFIs are also a special type of financial intermediaries. As financial intermediaries, they are also well-suited to handle some types of borrowers who can pose severe asymmetric information problems.[3] If different credit suppliers are specialized to different classes of borrowers in overcoming information problems, the natural reasoning is that *financial intermediaries in general*, not banks in particular, are special with respect to information. Like banks, for example, NBFIs overcome information problems by gathering private information about borrowers' credit quality—through evaluating the riskiness of their proposed projects, screening of their projects, and monitoring their postloan behavior. Furthermore, not only banks but also NBFIs can produce their private information by making an ongoing customer relationship with borrowers. Through the information production, NBFIs may develop their own specialties and accumulate their own "information capital." Because of their specialties in formation production, financial intermediaries as a whole are likely to have a comparative advantage over open-markets lenders who do not have such specialties.

Numerous empirical studies support the reasoning suggested above. Carey, Post, and Sharpe (1998) find that finance companies are skilled at serving relatively riskier borrowers who have a high probability of default by originating *asset-based*

[3] Just as banks, for example, are well-suited for making short-term business loans to information-problematic borrowers (especially small firms), finance companies are well-positioned for making collateralized loans to information-problematic borrowers (especially riskier firms), and insurance companies are well trained for making long-term loans to information-problematic borrowers (especially midsize firms), and so on.

lending—which is tied to borrowers' assets such as inventories, accounts receivable, and equipment. Carey, Prowse, Rea, and Udell (1993) and Prowse (1997) find that insurance companies are proficient at dealing with medium and large firms who pose somewhat "moderate" information problems by providing *long-term* bond-type loans—which are known as private placements.[4, 5] Such long-term loans are made at fixed rates because insurance companies can easily match this debt with their long term, fixed rate liabilities. Preece and Mullineaux (1994) and Billett, Flannery, and Jon (1995) find that, just as capital markets react positively to the announcement of "bank-loan agreements," the markets also respond positively to the announcement of "NBFI-loan agreements"—in particular, the announcement with debt-financing agreements with nonbank subsidiaries of bank holding companies or with nonbanking financial firms, such as finance companies and insurance companies. Similarly, employing a sample of 293 private placements of public utility debt, Szewczyk and Varma (1991) find that larger sales of public utilities' private placements have more favorable effects on their stock prices than smaller sales.

We have seen that different financial intermediaries may specialize in supplying loans to different classes of borrowers. The next question is how monetary policy influences the loan supply of all financial intermediaries, banks and NBFIs. There is no

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[4] The private placement is a security issued by a firm. The private placement must be sold to a limited number of institutional investors such as insurance companies and finance companies. It is exempted from registration with the SEC, and its initial offering and secondary transaction is not allowed in the markets.

[5] According to Prowse (1997), "*the private placement market* is an information-intensive market that shares much with the more familiar *bank loan market*: borrowers and lenders typically negotiate lending terms, lenders evaluate and monitor borrowers' credit risk, covenants are used to control risk and borrowers generally lack access to public debt market because they are too information-problematic for public market investors to evaluate" (p.12).

reason why monetary policy should selectively affect the loan supply of *just* banks. If instead monetary policy affected the loan supply of *both* banks and NBFIs in some general ways, then the loan status of all intermediaries may have influence on investment spending through intermediary-dependent borrowers. The linkage between monetary policy and the loan supply of banks and NBFIs can be justified by the following two procedures. First, according to the bank capital channel thesis (Van den Heuvel, 2002, 2007), monetary policy can influence the balance sheets, especially net worth, of these two kinds of lending institutions by way of a maturity mismatch of intermediaries' assets and liabilities. For example, as interest rates sharply rise after tightening monetary policy, most intermediaries whose assets have a longer maturity than their liabilities will suffer a decrease in their profits. This is because intermediaries must pay higher interest rates to renew their short-term borrowings before they have an opportunity to supplant the fixed-interest income from their long-term assets. The discrepancy between their interest expense and income squeezes intermediaries' profits, thus reducing their equity capital or net worth.

Second, subsequent to monetary policy impact on intermediaries' net worth, the ability of banks and NBFIs to raise uninsured external funds will be constrained because adverse selection becomes an issue in using *uninsured* sources of finance (Stein, 1998). For example, after the reduction of intermediaries' net worth, intermediaries must constantly make use of uninsured external funds to continue lending. In this situation, the lenders of uninsured funds would charge a higher lemon premium because an adverse selection problem would arise as a result of intermediaries' shrunken net worth. The line of reasoning I have suggested so far is as follows. Tight monetary

policy deteriorates the financial conditions of all financial intermediaries by decreasing their net worth. Because the fall of intermediaries' net worth makes their borrowing become less available and more expensive at the wholesale market, intermediaries may be forced to reduce the supply of loans to their own borrowers. If this reasoning is accurate, a fundamental tenet of the bank lending channel—which implies that banks play a unique role in the transmission mechanism of monetary policy—can and should be expanded to all private suppliers of credit.

This research paper attempts to examine the role of NBFIs in the transmission mechanism of monetary policy, both theoretically and empirically. First, drawing from Bernanke's (2007) general idea, I theoretically explain how contractionary monetary policy affects the quantity of loans of banks and NBFIs through changes in their balance sheet conditions, particularly net worth. If this theoretical explanation is correct, we should expect the *net worth* and the *intermediated loans* of both kinds of lending institutions to fall in response to a contractionary monetary policy shock. Second, therefore, I empirically test whether the net worth and the intermediated loans of banks and NBFIs decrease following tight monetary policy.

Employing the traditional Ordinary Least Squares (OLS) methodology and the Vector Autoregression (VAR) methodology, I find that NBFIs respond by shrinking their net worth, and then they presumably reduce the loans they extend to their clients in the same ways banks do. The reduction in the net worth of both banks and NBFIs is statistically significant in the traditional OLS model; nonetheless, the loan reduction made by NBFIs is not statistically significant, even though the signs of coefficients are in the expected negative directions. This evidence suggests that monetary policy, as the

theoretical explanation suggests, is likely to affect the *loan supply* of both bank and NBFIs through changes in their *net worth*; that is, NBFIs might be also influenced by monetary policy in the same manner as banks. More specifically, I then examine the behavior of aggregate loans and the behavior of components of loans—i.e., commercial and industrial (C&I) loans, mortgages, and consumer loans—following monetary tightening. I find that mortgages and consumer loans sharply *decrease* in response to a monetary policy shock, while C&I loans *increase*, which is consistent with the previous findings.

The remainder of this paper is organized in the following way: Section 2 presents an overview of NBFIs in the United Sates; Section 3 describes two theoretical explanation which posit that monetary policy actions can affect both banks and NBFIs; Section 4 describes the data and methodology employed in the study; Section 5 reports the empirical results of the study; and Section 6 summarizes and concludes the work.

2.2 An Overview of Nonbank Financial Institutions

Banks were the dominant financial institutions in the U.S. financial system. The majority of household savings were channeled into the traditional banks in the form of deposits. Yet, competition from NBFIs increased through financial innovation in the 1960s, 1970s, and early 1980s. As a result of competition, banks lost advantages of their traditional lines of businesses—i.e., making longer-term loans and funding them by issuing short-term deposits. As the profitability of such line of businesses was considerably diminished, banks were compelled to seek the new lines of business that produce a higher rate of return. On the other hand, as NBFIs fitted themselves rapidly

into the new environments by creating new financial instruments, they gradually increased their market shares.

2.2.1 Changes in the Structure of the U.S. Financial System

Prior to the Great Depression, many financial service operations—such as commercial banking operation, investment banking operation, insurance services operation, and so on—were generally performed within one organization, particularly commercial banks. During the Great Depression years 1930−1933, however, the United States experienced an unprecedented number of bank failures (in all 9,000 failures), which caused serious problems in the stability of the economy (Mishkin & Eakins, 2006).

The occurrence of the Great Depression provided a compelling reason for reform of the banking and financial system. Policymakers divided organizations performing several financial service operations into numerous organizations. In an attempt to prevent the reoccurrence of the Wall Street Crash of 1929, the operations of various financial services were legally broken up after the Great Depression. This is because policymakers considered an "inappropriate" activity of commercial banks—specifically, the participation of commercial banks in the stock market—as a main cause of financial crises. As an important first step, the Banking Act of 1933 (the Glass-Steagall Act) separated a commercial bank activity and an investment bank activity.[6] Later on, the Bank Holding Company Act of 1956 prohibited bank holding companies from

[6] The Banking Act of 1933 prohibited banks from being involved in investment bank activities such as underwriting of new corporate stock and bond issues and limited banks from obtaining risky securities; likewise, it prohibited investment banks from engaging in bank activities such as accepting deposits or making loans (Mishkin, 2012). See also Mishkin (2012) for the major financial legislations in the United States.

participating in most nonbanking activities and separated further commercial bank activity and insurance activity. The bank regulations, in this manner, built up many barriers in the financial system and created many NBFIs that perform a narrow range of functions in the segmented market. The financial system of the early 1950s, therefore, was highly specialized. Commercial banks focused on the short-term business lending; thrift institutions such as savings and loan associations, mutual savings banks, and credit unions specialized in long-term, fixed rate home mortgages; life insurance companies channeled most of their funds into the long-term corporate bonds; and investment banks handled the underwriting of new corporate stock and bond issues and the distribution of these securities to households (Sellon, 1992).

Not only were commercial banks restricted to the *scope* of their activities, but they were also restricted to *competition* among banks to protect their profitability—either by establishing entry barriers or by restraining price competition (Edwards 1993). Specifically, the McFadden Act of 1927 prohibited banks from branching across state lines, only permitting national banks to branch *within* the state of their location. Such branching restrictions shielded banks to operate in competitively-insulated markets. In addition, the Banking Act of 1933 and 1935 (Regulation Q) forbade the payment of interest on demand deposits and authorized the Federal Reserve to set interest rate ceilings on time and savings deposits. By Regulation Q, banks were protected against losing their competitiveness because they were able to tap into a cheap source of funds from households. Up until the low inflation periods of the mid-1960s, such restrictions functioned smoothly for the benefit of banks.

Yet, those benefits did not last. As an economic condition changed to the high

inflation periods of the late 1970s, bank regulations, which were designed to keep the banking system safe by limiting their competition, became more burdensome to banks. During these periods, *unregulated* NBFIs identified a great chance to serve a group of savers and borrowers. Ironically, such a new environment opened up an opportunity for NBFIs to invent new means of attracting household savings and thus accelerated the progress of financial innovations.

More specifically, in early 1978, the economic environment changed rapidly as inflation rose and market interest rates started to soar over 10%. At this time, the maximum interest rates payable on savings account and time deposits under Regulation Q were 5.5% (Mishkin, 2012). When the market interest rates, therefore, rose above the interest rate ceiling, households were strongly incentivized to withdraw their savings from banks and put these funds into higher-yielding securities through NBFIs. In particular, such transfer of household savings was feasible by the invention of money market mutual funds (MMMF) in 1971. This particular type of financial innovation allowed depositors, whose bank deposits were paying below-market interest rates due to Regulation Q, to enjoy higher market rates.

In company with the rapid expansion of money market mutual funds, pension funds also grew explosively after World War II. At the end of World War II, there were a small number of pension plans. During the 1950s and the1960s, the majority of increase in pension fund assets was caused by the *creation of new pension plans*, as retirement benefits became an essential part of collective bargaining and other wage negotiations. Starting in 1970, the expansion of new pension plans began to slow down. During the 1980s, the growth in pension assets was caused by an *increased value of contributions*,

or savings, rather than by growth of new plans (Sellon, 1992). Favorable tax treatment was also a main factor behind the rapid growth of pension funds. By Federal tax law, employers were able to receive the tax deduction from their pension contributions. Employees were currently exempted either from the taxes on their contributions or from interest on pension assets, and taxes were deterred until employees' retirement. Employers, thus, were significantly incentivized to pay benefits in the forms of pension contributions, and individuals were also encouraged to save through pension plans rather than through a taxable form of other savings (Sellon, 1992).

Over the postwar period, as household savings shifted from traditional depository institutions (banks, thrifts, and credit unions) and direct holding of securities (stocks and bonds) to NBFIs—especially mutual and pension funds—these institutions became an important part of U.S. financial system.[7] Such a shift of household savings led to the rapid growth of NBFIs. The significant expansion of NBFIs had profound effects on the U.S. financial system. Such expansion has essentially changed the intermediation process in the direction of the market-based intermediation[8] and thus changed the role of the traditional banking industry.

NBFIs have influenced the intermediation process toward the market-based intermediation by supporting the expansion of the "financial market." For example, since the 1970s, money market mutual funds played a key role in boosting the growth of

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[7] According to Sellon (1992), "[i]n 1952, households held only 6 percent of their financial assets in pension funds and less than 1 percent in mutual funds. By 1991, however, households placed 27 percent of their financial assets in pension funds and nearly 10 percent in mutual funds.…Thus, direct holdings of stock fell from 32 percent of household financial assets in 1952 to 18.5 percent in 1991" (p.56). Households also reduced direct holdings of bonds by somewhat smaller amounts.

[8] Market-based intermediation is defined here as the intermediation associated with the *financial market* and with the *securitization process*, rather than the intermediation associated with the traditional banking industry.

the commercial paper (CP) market—by purchasing CP issued by finance companies. Prior to the 1970s, finance companies used bank loans more than CP as a source of their lending. However, since the 1970s, they have increasingly used CP much more, mainly due to the emergence of money market mutual funds as a main credit supplier of the CP market.[9]

The change in finance companies' main source from bank to CP market was associated with the large shift of household savings that resulted in the rapid growth of money market mutual funds. "Since the late 1970s and early 1980s, much of large inflow of household savings into money market funds has been channeled into the purchase of commercial paper" (Sellon, 1992, p. 65). In addition to purchasing CP, NBFIs have increasingly bought a large amount of stocks and bonds in the financial market. During the last several decades, while direct holdings of stocks and bonds by households have sharply diminished, indirect holdings of these securities by mutual and pension funds have significantly increased (see Sellon, 1992; Edward 1993).[10]

NBFIs have also influenced the intermediation process toward the market-based intermediation by supporting the expansion of the "securitized loan market." Similar to what happened to the CP market, since the 1970s, most of household savings that had been put into mutual and pension funds have been channeled into the purchases of the mortgage-backed securities. With the innovation of securitization, previously illiquid

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[9] In particular, the CP market actually exploded, growing from $121.6 billion in 1980 to $528 billion in 1991 (Post, Schoenbeck, & Payne, 1992). Edwards (1993) also notes that during this period, "finance companies alone accounted for almost two-thirds (or $322.8 billion) of the newly issued commercial paper in 1991" (p.26).

[10] "Households have been net sellers of stock in every year but one since 1958. In 1952 households held 91 percent of all corporate stock outstanding; in 1991 they held only 53 percent. During this period the share of total outstanding stock held by pension and mutual funds rose from 3 percent to 34 percent" (Edwards, 1993, p. 49).

mortgages loans held by banks can be transformed into marketable securities. These securities, in turn, can be freely sold to investors—without transfer of title of individual mortgages that was required previously (Allen & Santomero, 1997).[11] In particular, institutional investors such as mutual funds, pension funds, and insurance companies purchased these mortgage-backed securities, meeting vigorously growing demand for such securities. The success of the mortgage-backed securities resulted in other types of securitization such as consumer loans, bank loans, automobile loans and credit card receivables during the 1980s. By purchasing a large amount of mortgage-backed securities and asset-back securities, mutual and pension funds have encouraged market-based intermediation as well.

While supporting the growth of the market-based intermediation, mutual and pension funds also changed the role of the traditional banking industry in the U.S. financial system. They undermined the profitability of banks' traditional lines of business—i.e., making loans and funding them by issuing deposits. As noted earlier, the profitability of banks has been squeezed by direct competition with money market mutual funds, mainly due to the increase in banks' cost of funding. In addition, mutual and pension funds supported the growth of the financial markets such as CP and bond markets, eroding the market share of the traditional bank lending business. For example, as the CP market grew rapidly due to the participation of money market mutual funds in the CP market, large firms were able to obtain short-term funds in the CP market more frequently instead of running to banks. Small firms also can borrow from finance

[11] Specifically, the introduction of "pass-through" securities by Government National Mortgage Association (Ginnie Mae) played a key role in popularizing the securitization of mortgages in terms of the volume of transactions in 1970.

companies, which obtain much of their short-term finance in the CP market, as an alternative to bank lending.

Banks' lower profitability and loss of market share have been recuperated in the following two procedures. First, bank regulations have been gradually reduced since 1980.[12] Banks, thus, were able to compete more efficiently with NBFIs. To compete with money market mutual funds, banks were legitimately allowed to provide new financial instruments such as negotiable order of withdrawal (NOW) accounts and money market deposit accounts (MMDAs).[13] Second, banks were forced to search for nontraditional financial activities—e.g., off-balance sheet activities—as a way of maintaining their profits. In particular, such activities were the expanding role of banks as dealers in *derivatives products* and as originators of *securitization* and thus were risker than traditional banking activities. Although banks were able to create more income with these nontraditional activities, they were exposed to substantial risk by carrying out these activities. In any case, these two procedures described above improved banks' profits and helped to make banks more competitive in the chase of funds.

[12] Interest rate ceilings under Regulation Q were phased out and eventually eliminated for all deposits except demand deposits in March 1986. The Riegle-Neal Interstate Banking and Branching Efficiency Act of 1994 repealed the McFadden Act and permitted banks to establish branches nationwide by eliminating barriers to interstate banking at the state level. The Gramm-Leach-Bliley Act of 1999 repealed the Glass-Steagall Act and allowed commercial banks, investment banks, and insurance companies to offer each other's products for the first time since the Great Depression (Mishkin, 2012).

[13] NOW accounts are deposit accounts that pay interest; MMDAs are savings accounts that pay interest based on the current interest rates, similarly to money market mutual funds.

2.2.2 The Growth of NBFIs

As NBFIs increased their profits in competition with banks, they also have substantially increased the market share of their businesses in the U.S. financial system since 1980. Table 2.1 shows this situation from 1959 to 2009. Over 50 years from 1959 to 2009, the assets of banks had significantly dropped from 55.1 to 26.9% of financial sector assets. In contrast, during this period, the assets of institutional investors —i.e., the sum of assets between mutual funds and pension funds—had considerably increased from 14.9 to 32.8% of financial sector assets; the assets of government sponsored enterprises (GSEs) and Federally Related Mortgage Pools had grown explosively from 1.8 to 13.8% of financial sector assets. These figures clearly indicate that the assets of the traditional banking industry had sharply shrunk, whereas the assets of NBFIs had substantially grown.

As noted in the previous subsection, this remarkable growth of NBFIs was associated with household savings that shifted away from the traditional banking industry to NBFIs, such as mutual and pension funds and other institutional investment pools. In competition with banks for attraction of household savings, mutual and pension funds became the biggest winners. Different factors contributed to each institution's growth. The rapid growth of pension funds resulted mainly from changes in tax laws for pension funds, which provide some tax advantages for both employers and employees to their contributions or savings. On the other hand, the remarkable growth of mutual funds resulted from the new economic environment such as high inflation and bank regulations in the United Sates. To survive in such new economic environment, NBFIs created new financial instruments and were successfully able to attract

Table 2.1 Outstanding Assets Held by Financial Sectors
(billions of dollars and percent)

A. Amount Outstanding (billions of dollar, at year end)

	1959	1969	1979	1989	1999	2009
Banks[1]	327.3	721.5	2150.6	4946.6	7563.2	16299.4
Insurance Companies[2]	135.1	237.5	581	1748.5	3937.8	6208.9
Pension Funds[3]	67.3	192.3	649.1	2634.1	7693.6	9481.2
Mutual Funds[4]	21.3	56.2	104.9	1066.8	6270.2	10454.1
GSE& Federally Related Mortgage Pools[5]	10.6	39.5	260.4	1323.7	4016.7	8390.2
Issuers of Asset-backed Securities	0	0	0	209.8	1320.5	3376.1
Finance companies	25.6	67.1	200.5	568.6	1016.7	1662.5
Security Brokers and Dealers	6.2	15.4	32.7	236.6	1001	2084.2
Others[6]	0.2	3.6	6.3	249.3	1134.8	2695.5

B. Percentage of Total Financial Sector Assets

Banks	55.1	54.1	54	38.1	22.3	26.9
Insurance Companies	22.8	17.8	14.6	13.5	11.6	10.2
Pension Funds	11.3	14.4	16.3	20.3	22.7	15.6
Mutual Funds	3.6	4.2	2.6	8.2	18.5	17.2
GSE& Federally Related Mortgage Pools	1.8	3	6.5	10.2	11.8	13.8
Issuers of Asset-backed Securities	0	0	0	1.6	3.9	5.6
Finance companies	4.3	5	5	4.4	3	2.7
Security Brokers and Dealers	0	0.3	0.2	1.9	3.3	4.4
Others	0	0.3	0.2	1.9	3.3	4.4

Source: Federal Reserve System, *Flow of Funds Accounts of the United States.*

1. Includes commercial banks, saving institutions, and credit unions.
2. Includes life insurance companies, and property-casualty insurance companies.
3. Includes private pension funds, state and local government employee retirement funds, and federal government retirement funds.
4. Includes money market mutual funds, mutual funds, and close-end and exchange-traded funds.
5. GSE stands for government sponsored enterprises.
6. Includes real estate investment trusts, and funding corporations.

household savings.

The expansion of NBFIs is even more pronounced when viewed in term of holdingsof outstanding corporate equity. Table 2.2 shows the outstanding corporate equity owned by households, NBFIs, and others from 1959 to 2009. Over 50 years from 1959 to 2009, while households had substantially decreased the direct holdings of corporate equity from 86.3 to 36.2% of financial sector assets, NBFIs had dramatically increased the holding of corporate equity from 11 to 50.1% of financial sector assets. In particular, during the same period, the assets of two major institutional investors,

Table 2.2 Holdings of Corporate Equity
(in billions of dollars and percent; amounts outstanding at the end of each year)

	1959	1969	1979	1989	1999	2009
A. Households						
Amounts	$357,289	$667,356	$768,059	$2,147,477	$9,769,854	$7,247,382
Percent	86.4	79.4	66.9	56.3	50.4	36.2
B. NBFIs*						
Amounts	$45,604	$143,920	$319,101	$1,370,815	$8,063,790	$10,020,423
Percent	11	17.1	27.8	40	41.6	50.1
Pension Funds & Mutual Funds						
Amounts	$33,273	$115,593	$252,843	$1,180,978	$6,848,853	$7,750,265
Percent	8	13.8	22	31	35.3	38.8
C. Others						
Amounts	$566	$1,870	$2,566	$14,078	$66,885	$124,151
Percent	2.6	3.5	5.2	7.7	8.1	13.7

* Note: NBFIs include pension funds, mutual funds, insurance companies, closed-end funds, exchange-traded funds, and brokers and dealers. Others include state and local governments, federal government, rest of the world, commercial banking, and savings institutions.

Source: Federal Reserve System, *Flow of Funds Accounts of the United States*

mutual funds and pension funds, have exponentially grown from 8 to 38.8% of financial sector assets.

Taken as a whole, the evidence presented here indicates that, as households shift their savings away from traditional banking industry to two major institutional investors (Table 2.1), households have sharply increased *indirect* holdings of stocks through these institutional investors, while they have sharply decreased *direct* holdings of stocks (Table 2.2). Consequently, we can see that the role of NBFIs in the financial intermediation significantly increased over the 50-year period.

2.2.3 Market Share of Credit

Employing the flow of funds data, I examine the market share between banks and NBFIs in the U.S. credit market.[14] Before we examine the market share between these two kinds of institutions, Figure 2.1 exhibits the distribution of total credit (i.e., *all* financial institutions' credit) by four different credit types from 1959 to 2009—bank loans, mortgages, consumer loans, and other loans and advances.[15]

Of different types of credit, mortgages are the largest part of total credit provided to households and businesses, accounting for about 50 to 70% of total credit. The market share of mortgages continued to increase over 50 years at the loss of market share of bank loans and consumer loans. In 1959, for example, mortgages' market share was 52%, but it had substantially increased to 72% by 2009. Bank loans were the second

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[14] Credit here is defined as loans supplied to households and businesses excluding trade credit.

[15] "Other loans and advances" are loans of various types that do not fit into the categories of bank loans mortgages and consumer credit. They, for example, include credit supplied by financial institutions such as customers' liability on acceptance outstanding, bank holding company loans, policy loans, government sponsored- enterprise loans, securitized loans issued by ABS issuers, finance company loans to business, and loans to nonfinancial corporate business (Federal Reserve, 2000).

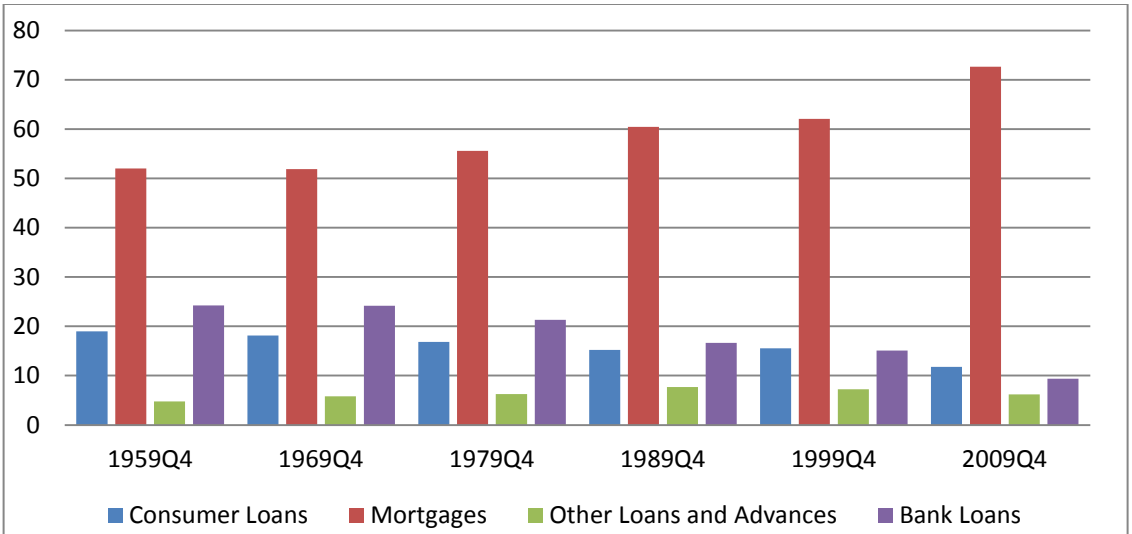

Figure 2.1 Distribution of Total Credit by Credit Type

largest part of total credit supplied to businesses in 1959, accounting for 24% of total credit. By 2009, however, the market share of bank loans had significantly dropped to 9%, which is a smaller than the market share of consumer loans. The market share of consumer loans had declined from 19% in 1959 to 12% in 2009, but the decline of consumer loans' share is somewhat slower than that of bank loans. Other loans and advances, which are the smallest chunk of total credit, had slightly increased from 5% in 1959 to 6% in 2009. Overall, mortgages have become a larger share of total credit, while bank loans and consumer loans have become a smaller share of total credit between 1959 and 2009.

Figures 2.2 to 2.5 exhibit the market shares between banks and NBFIs in total credit and components of loans. As shown in Figure 2.2, NBFIs had substantially increased the market share of total credit over 30 years. In the 1950s, they played a small role in the credit market. In 1959, for example, NBFIs provided only 17% of total credit with the U.S. economy. By 2009, however, they accounted for 59% of total credit supplied.

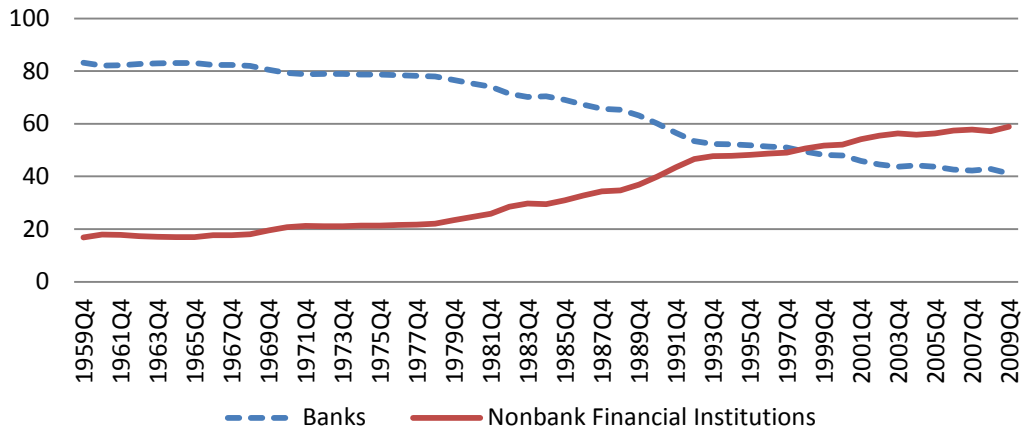

Figure 2.2 Total Credit

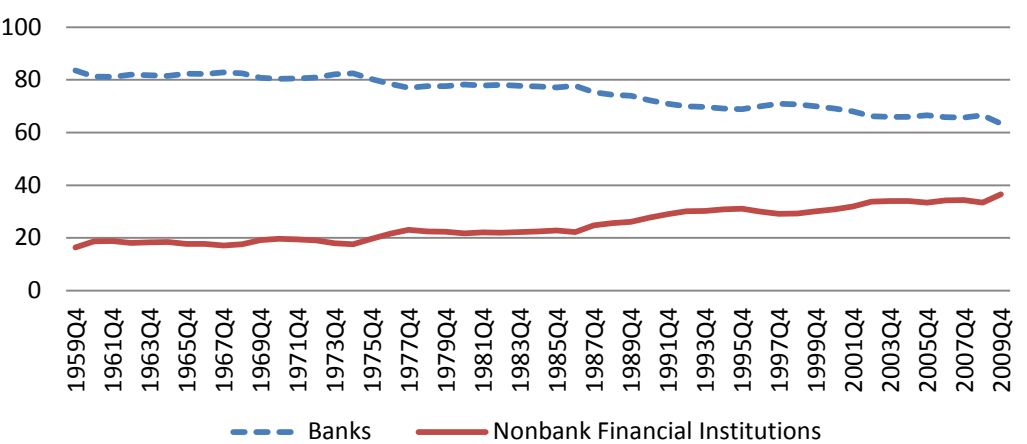

Figure 2.3 Commercial and Industrial Loans

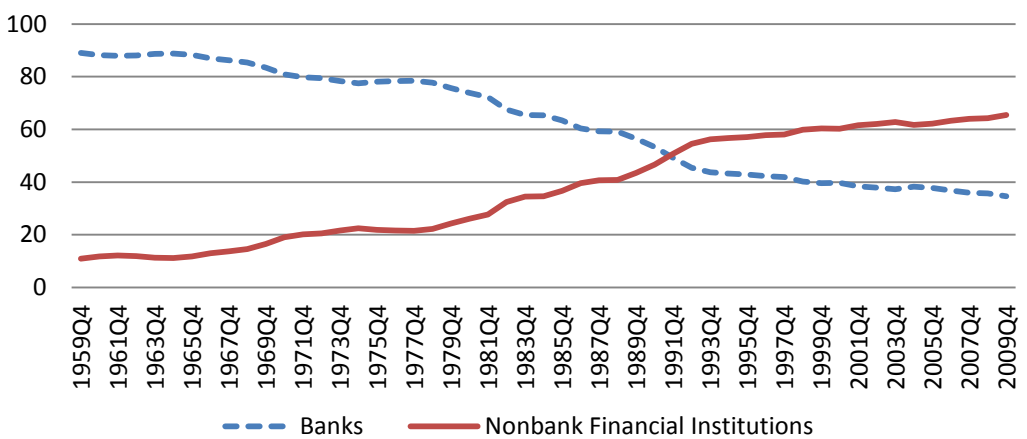

Figure 2.4 Mortgages

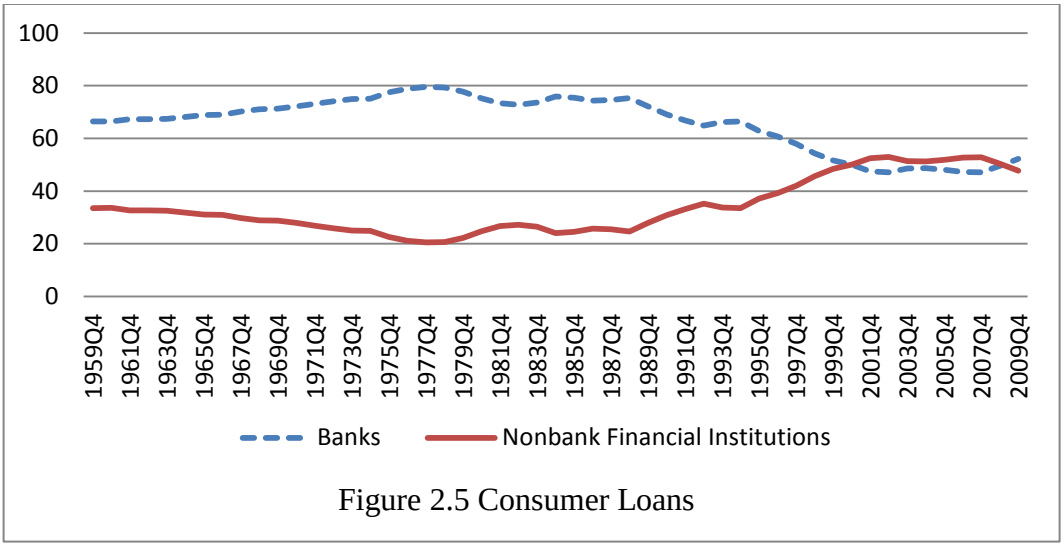

Figure 2.5 Consumer Loans

In particular, notice that the market share of NBFIs overturned that of banks in 1998.

Figure 2.3 shows the market share between these two kinds of institutions in commercial and industrial loans (C&I loans). C&I loans are calculated as the sum of "bank loans" and "other loans and advances" at nonfarm nonfinancial corporations and nonfarm noncorporate businesses, as defined by the Federal Reserve Board's flow of funds accounts.[16] NBFIs had gradually increased the market share of C&I loans over 50 years, eroding the corresponding market share of banks. In 1959, NBFIs accounted for 16% of C&I loans; by 2009, they increased their share by 37%. As shown in Figure 2.4, the change of mortgage market is much more dramatic than that of the C&I loan market. During the same period, NBFIs have considerably increased the market share of mortgages. In 1959, NBFIs accounted for only 11% of mortgages. By 2009, however, they sharply increased to 65%. As shown in Figure 2.5, NBFIs lost market share of

[16] For commercial banks, the data of C&I loans are collected in the form of "bank loans" in balance sheets of commercial banks. Yet, for NBFIs, the same data are gathered in the form of "other loans and advances" in the balance sheets of nonbanks financial institutions. This is because nonbanks' business loans are classified in "other loans and advances." Also, savings institutions and credit unions, which are categorized into banks in this study, have their C&I loans in the "other loans and advances" item in their balance sheets.

consumer loans to banks by the mid-1970s, indicating from 34% in 1959 to 20% in 1977. Then, they continued to increase to about 52% until the early 2000s.

2.3 A Theoretical Explanation

2.3.1 The External Finance Premium of Financial Intermediaries

This section presents a justification of how monetary policy influences the financial condition of banks and NBFIs, which in turn reduces the loan supply to intermediary-dependent borrowers. One explanation is the *external finance premium of financial intermediaries* suggested by Bernanke (2007). To describe the main theme of the external finance premium, consider this situation: All intermediaries, which retain a deficient internal source of funds (funds controlled by insiders), must turn to external sources of finance (funds from outsiders) to maintain their lending businesses. Under this situation, if a monetary tightening substantially reduces the intermediaries' net worth, such a reduction makes them less creditworthy in the lenders' eyes. As the lenders of external sources of finance see the intermediaries' credit risk increase, the lenders' concerns about intermediaries' credit quality create an external finance premium or a lemon premium, which will be explained shortly. This premium makes external sources of funds more expensive and less available in the wholesale market. Therefore, all intermediaries that are constrained to raise funds must curtail their supply of loans to businesses, which can be thought of as intermediary-dependent borrowers.

Essentially, the explanation presented above is based on a theory of the bank lending channel, which holds that the monetary policy influences, in part, the willingness of banks to lend. The bank lending channel is extended to nonbank lenders, who similarly provide credit to businesses, by introducing a concept of the external

financial premium. According to Bernanke (2007), "the idea underlying the bank-lending channel might reasonably extend to all private providers of credit [lenders of NBFIs]" (Bernanke, 2007, n.p.).

2.3.1.1 The Impact of Monetary Policy on All Financial Intermediaries

If the idea of the bank-lending channel can be broadened to all suppliers of credit, as suggested by Bernanke (2007), questions naturally arise: How does monetary policy influence NBFIs compared to banks? What is a rationale behind his argument? According to Bernanke's argument, monetary policy may be able to influence both banks and NBFIs when we pay attention to the *financial condition of intermediary borrowers*[17] and its relationship with *the cost of funds* in the wholesale market. Such a main argument can be understood more clearly in the two sequential procedures: (1) Monetary policy actions must be able to shift the financial conditions of both banks and NBFIs; subsequently, (2) such a change in intermediaries' financial condition should influence the cost of funds available to intermediary borrowers in the wholesale market.

In the first procedure, monetary policy actions must be able to shift not only the financial condition of banks but also that of NBFIs. We may think that this procedure is initially problematic. The reason is that monetary policy, according to the conventional bank lending channel, affects the supply of loans from *only* depository institutions through changes in bank *reserves*. Hence, NBFIs that are not subject to reserve requirements cannot be influenced by monetary policy. To address this issue, we can introduce the idea of the bank capital channel (Van den Heuvel, 2002, 2007), which

[17] The financial condition of borrowers can be "measured in term of factors such as [borrowers'] net worth, liquidity, leverage, and current and future expected cash flows" (Bernanke 2007, n.p.).

maintains that monetary policy affects the supply of bank loans, in part, through *direct* changes in bank's *equity capital* (also called net worth). Since NBFIs must retain equity capital on their balance sheet, the bank capital channel thesis can be reasonably applied to NBFIs. Monetary policy, then, can influence *all* intermediaries' balance sheet through its direct impact on their equity capital.[18]

Van den Heuvel (2002, 2007) asserts that monetary policy can have a direct impact on intermediaries' equity capital through changes in their profits. In banking theory, an important function of banks is maturity transformation, which can be described as "the transformation of securities with short maturities, offered to depositors, into securities with long maturities that borrowers desire" (Freixas & Rochet, 2008, p. 4). The same maturity transformation function is performed by NBFIs, such as financial companies, funding companies, and issuers of asset-backed securities (ABS). Although these institutions lack access to insured deposits, they can raise funds by issuing short-term debt in money market and make loans with longer maturities. So, we can reasonably say that financial intermediaries in general perform a maturity transformation function—i.e., borrowing short and lending long.

As a result of the maturity transformation, intermediaries are exposed to interest rate

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[18] The level of equity capital can be directly influenced by monetary policy in two ways: (1) through changes in intermediaries' profits and (2) through changes in their stock prices. Although Van den Heuvvel (2002, 2007), as will be described shortly in this section, argues that monetary policy has an impact on intermediaries' equity capital through changes in profits, I also suggest that monetary policy may be able to directly influence their equity capital through changes in their *stock prices*. A sharply rising interest rate (induced by tight monetary policy) is directly able to reduce the stock prices of intermediaries, according to the following two explanations: the severely discounted value of future stocks' dividends and the increased expected returns on other financial assets (Bernanke, 2003). A larger number of scholars empirically find that unexpected tighter or easier monetary policy is associated with an increase or decrease, respectively, in the overall U.S. stock prices (Bernanke, 2003; Bernanke & Kuttner, 2005; Rigobon & Sack, 2004; Thorbecke, 1997) In particular, English, Van den Heuvel, and Zakrajsek (2012) find that unanticipated changes in interest rate induced by FOMC announcement have large negative effects on bank stock prices.

risk.[19] Changes in market interest rates induced by monetary policy actions can cause intermediary profits to fluctuate. For example, as market interest rates sharply rise after tightening monetary policy, the "interest expense" from short-term debts grows more rapidly than the "interest income" from long-term assets. The discrepancy between the interest income and expense squeezes intermediaries' profits, therefore reducing their equity capital. Such a reduction of net worth is more serious for financial intermediaries because they are highly leveraged institutions compared to nonfinancial firms. A small change in their profits may lead to a large fluctuation in their net worth.

In particular, the thesis of the bank capital channel is empirically supported by the findings of Adrian, Estrella, and Shin (2010). According to the reasoning of Adrian et al. (2010), monetary policy affects the intermediaries' equity capital through changes in the *term spread* and *net interest margin* (NIM). The term spread is the difference between the yields long-term and short-term Treasury securities. Under an assumption that the short-term interest rates accumulated and expected determines the term spread, Adrian et al. find that there is a negative relationship between changes in the Fed Funds target and changes in the term spread. Furthermore, they examine net interest margin, which is the difference between the interest income generated by intermediaries and the interest expense paid out to their lenders.[20] Exploring a hypothesis that the term spread influences the intermediaries' net interest margin, Adrian et al. also find that a decrease in the term spread reduces net interest margin of large commercial banks from their Y-

[19] Interest rate risk is "the risk that the value of financial assets and liabilities will fluctuate in response to changes in market interest rates" (Hubbard, 2005, p. glossary A-7).

[20] The term spread exhibits the profitability of *marginal* loans that is increased to intermediaries' balance sheets, whereas net interest margin (NIM) is a concept of *averages* about total assets and total liabilities. In other words, NIM is associated with the interest earned on loans and other assets on the asset side and the interest paid on borrowed funds on the liability side *in a time period*.

9C filings. Therefore, the evidence suggests that an increase in the short-term interest rate (caused by a monetary tightening) reduces the term spread of intermediaries, which in turn decreases their net interest margin, thereby squeezing the intermediaries' equity capital.

In the second procedure, subsequent to monetary policy impact on intermediaries' financial condition, a change in intermediaries' financial health should influence the cost of funds available to borrowers in the wholesale market.[21] Why is the cost of funds closely associated with the financial health of borrowers? To shed light on this relationship, presenting a concept of an "external finance premium" is helpful. The external finance premium is defined as the difference between the cost of external funds (funds raised from outsiders) and opportunity cost of internal funds (the firm's cash flows or funds controlled by insiders) (see Bernanke, 1993). In fact, external funds are always more expensive to the firm than internal funds because outside lenders cannot perfectly observe and control the risk associated with their lending to firms due to asymmetric information problems and thus must bear the cost of evaluating firms' prospects and monitoring firms' actions.

Although such a concept is defined in terms of *firms* and is used in the firms' balance sheet channel literature, the same concept can be applied to financial intermediaries as well. Just like nonfinancial firms, the information about intermediaries' activities may be difficult for outside lenders to observe, which, in turn, can create for

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[21] Of course, for the second procedure to operate, both banks and NBFIs must resort to nondeposit sources of funding in the wholesale market. In particular, NBFIs that lack access to insured deposits must depend on nondeposit funds as a main source for their lending. Banks also have increasingly used the same nondeposit funds to supplement a traditional source of deposits (Feldman & Schmidt, 2001)—as a consequence of high competition for household savings from institutional investors. Thus, these two lending institutions have become increasingly dependent on nondeposit funds.

asymmetric information problems for intermediaries themselves when they must raise external funds. The idea of the balance sheet channel for *intermediaries*, which is that intermediaries may be subject to financial frictions in a similar way to nonfinancial firms, was suggested by many researchers such as Kashyap and Stein (1995) and Stein (1998).[22]

In particular, of those researchers, Stein's (1998) adverse selection model gives us some insight into how banks and NBFIs can be subject to the same financial frictions when using uninsured external funds. According to Stein's model, if banks that mainly use insured deposits in their lending businesses are someway forced to tap into uninsured external funds, then their ability to raise these funds will be constrained. This is because the banks' private information about the value of their loans creates an adverse selection problem, which makes the employment of uninsured external funds costly. On the other hand, insured deposits are an exceptional source of finance for banks, allowing them to avoid such problems. In this respect, similar to what happens to nonfinancial firms, insured deposits can be thought of as a form of *internal funds*, like cash flows, because there is no adverse selection problem between banks and depositors in the presence of deposit insurance (Jayaratne & Morgan, 2000). Yet, uninsured nondeposit funds can be thought of as a form of *external funds* because there is an adverse selection problem between banks and lenders to uninsured nondeposit funds. Because of such a problem posed by banks in uninsured external funds, uninsured funds are intrinsically more costly to banks than insured deposits. Likewise, since NBFIs pose the same adverse selection problem when using uninsured external funds, these

[22] See, for example, Kashyap and Stein (1995), Houston, James, and Marcus (1997), Stein (1998), and Jayaratne and Morgan (2000).

uninsured funds are more expensive to them than cash flows. Therefore, NBFIs as well as banks, which pose the information problems to lenders of uninsured external funds, can fall into the adverse selection model.

Importantly, the cost of uninsured external funds depends on the financial health of intermediaries, the creditworthiness of intermediaries to lenders. In the market for uninsured nondeposit funds, adverse selection becomes an important issue because intermediaries have more information about their loan quality than the lenders of nondeposit funds. Thus, uneasiness of lenders of nondeposit funds about the intermediary loan qualities creates an external finance premium, or a *lemon* premium, for intermediaries. The external finance premium is created by intermediaries in the same way as it is created by nonfinancial firms in the balance sheet channel. Essentially, the theory predicts that the external finance premium a borrower must pay should rely on the strength of the borrowers' financial condition—the larger the borrowers' net worth is, the smaller the external finance premium should be.[23] So, intermediaries' net worth affects their external finance premium and thus their cost of uninsured external funds.

For example, if contractionary monetary policy reduces intermediaries' net worth substantially and if intermediaries must turn to nondeposit external finance to maintain lending, then, the cost of nondeposit funds will significantly increase. The external-financial premium paid by financial intermediaries, in turn, will be passed in the cost of funds to intermediary-dependent borrowers. That is, financial intermediaries, who must

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[23] "Intuitively, a stronger financial position (greater net worth) enable a borrower to reduce her potential conflict of interest with the lender, either by self-financing a greater share of her investment her project or purchase or by offering more collateral to guarantee the liability she does issue" (Bernanke, 1995, p. 35).

pay the higher external-financial premium, will respond by reducing the loan supply directly or by increasing the loan rate they offer customers at the retail market.

2.3.1.2 Specialness of Intermediated Loans in General

The argument for "specialness of intermediated loans in general" is essentially based on a theory of the bank lending channel. According to the bank lending channel, the shift of monetary policy influences the loan supply from banks through changes in bank reserves, ultimately affecting investment opportunities available to bank-dependent borrowers. More detailed description is as follows: An open market sale conducted by a central bank reduces bank reserves in the banking system. Then, banks, which undergo a resulting reduction in reserve-backed deposits, must raise substitutable nondeposit funds to make up for these reduced reserve-backed deposits. When banks tap into nondeposit sources of funding to continue lending, (because nondeposit funds are more expensive than deposits), banks are forced to reduce the loan supply to bank-dependent borrowers.[24] Subsequently, the contraction of loan supply from banks may have different effects on different-size firms. While large firms can obtain funds directly from the public markets without going through banks, small firms cannot obtain substitutable funds and thus must reduce their investments. In aggregation, after all, this process leads to the reduction of investment in the economy.

In this bank lending channel theme, banks are special because they are well-positioned to deal with some classes of borrowers, who pose severe information problems in the credit market. There is "asymmetric information" between lenders and

[24] There are two conditions for the bank-lending channel to exist: (1) monetary policy must be able to shift the supply of bank loans, and (2) there must "exist" bank-dependent borrowers, who may not be able to obtain credit elsewhere (see Bernanke & Blinder, 1988; Kashyap & Stein 1994).

borrowers to the extent that borrowers have more information about the credit quality than lenders. Such borrowers—particularly households, farmers, and small firms—may be unable to obtain credit elsewhere owing to the information problems to lenders. In this situation, banks play a unique role in overcoming the information problems in the credit markets. They specialize in gathering information about borrowers' prospects and in monitoring their postlending performance. The banks' in-depth knowledge about borrowers allows information-problematic borrowers to obtain credit. Therefore, in the bank lending channel, *only* banks are a special type of financial intermediary that provide loans to these information problematic borrowers.

A large number of economists, however, suggest that NBFIs, just like banks, are unique in the credit markets because they are also well-adapted to handle different types of borrowers. In that regard, it appears that other financial intermediaries are also specialized to different types of borrowers. Carey et al. (1998) suggest that finance companies specialize in the asset-based loans—loans based on borrowers' accounts receivable, inventories, and equipment—because they deal with very risky borrowers. Carey et al. (1993) and Prowse (1997) suggest that insurance companies specialize in the long-term loans to the "medium to large borrowers," who pose somewhat moderate information problems to lenders. Thrift institutions and mortgage companies may specialize in home mortgage lending to households. In contrast to credit supplying intermediaries, some financial intermediaries do not provide credit directly to businesses and households, but they may *indirectly* influence the credit supplied in the economy. For example, the fund managers of pension or mutual funds, who may have superior knowledge of future prospects for firms, may be good at picking up more

profitable securities such as stocks and bonds. So, they may indirectly influence the credit supply through changes in the prices of securities.[25] Investment banks also play a somewhat different role in the intermediation process. Rather than attracting household savings and investing in different sectors of the economy, investment banks deal with the underwriting of new firm stock and bond issues as well as the distribution of such securities to individuals.

Accordingly, our reasonable thought is that *financial intermediaries in general* specialize in overcoming information problems of different types of borrowers. By developing expertise in gathering material information, as well as by maintaining continuous relationships with customers, each financial intermediary may accumulate their own "informational capital." This information capital allows intermediaries to address information problems about some classes of borrowers more easily than the financers of public debt market. For this reason, *all* financial intermediaries have a comparative advantage over the financers of public debt markets.[26] In support of this view, a large number of researchers find that intermediated loans in general play a unique role in the credit markets, rather than that only bank loans do, as the theory of the bank lending channel would argue (see Szewczyk & Varma, 1991; Carey et al. 1993, 1998; Preece & Mullineaux, 1994; Billett, Flannery & John, 1995).

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[25] For instance, if a firm's profit is expected to increase in the future, fund managers will purchase the firm's stocks or bonds and increase the price of these securities. Then, the higher prices in stocks or the lower interest rate in bonds makes the firm easier to finance, which in turn increases the credit supplied in the economy.

[26] Although financial intermediary loans in general are special to intermediary-dependent borrowers, bank loans, insurance company loans, and finance company loans are not likely to be identical. Each has its own specialty to different information-problematic borrowers.

2.3.1.3 Expansion of the Bank Lending Channel

So far, the discussion about the NBFIs—the impact of monetary policy on all intermediaries and the specialties of intermediated loans in general—provides a reasonable explanation of how a monetary policy action can influence the loans supplied by *intermediaries in general* through changes in their net worth. To reiterate, tight monetary policy can deteriorate the financial condition of *all* intermediaries through the reduction of their net worth. (This mechanism operates through the bank capital channel.) Subsequently, when intermediaries must turn to uninsured nondeposit funds (in the wholesale market), the reduction of their net worth makes intermediaries less creditworthy. As the lenders of the uninsured nondeposit funds see the intermediaries' credit risk increase, the lenders increase the external finance premium, or a lemon premium, to the borrowers. (This situation is justified by the adverse selection model). After all, intermediaries that are constrained to raise nondeposit funds should respond by reducing the loan supply to intermediary-dependent borrowers.

Such an explanation can be thought of as a broad view of the bank lending channel because the bank capital channel—which is in the same line with the bank lending channel in that monetary policy can influence the willingness of the loan supply through changes in the quality of banks' balance sheets—is applicable to NBFIs as well as banks. After tightening monetary policy, NBFIs, which undergo the shrinkage of their net worth, face the higher external finance premium in using nondeposit funds in the same way as banks. NBFIs, in turn, must reduce the supply of loans to borrowers just like banks. Because of the similarity between banks and NBFIs in the credit markets, the idea of the bank lending channel—the fundamental idea that banks play a special

role in the transmission of monetary policy—can be reasonably expanded to NBFIs. Bernanke (2007) describes the central idea of this mechanism in the following manner.

> Like banks, nonbank lenders have to raise funds in order to lend, and the cost at which they raise those funds will depend on their financial condition--their net worth, their leverage, and their liquidity, for example. Thus, nonbank lenders also face an external finance premium that presumably can be influenced by economic developments or monetary policy. The level of the premium they pay will in turn affect the rates that they can offer borrowers. Thus, the ideas underlying the bank-lending channel might reasonably extend to all private providers of credit (Bernanke, 2007, n. p.).

2.4 Data Description and Methodology

2.4.1 Data Description

The balance-sheet data of financial intermediaries are available from various issues of the *Flow of Funds Accounts of the United States*, hereinafter called the Flow of Funds Accounts or the FFA. The publication is issued quarterly by the Federal Reserve System.[27] The data sets for the empirical test utilized in this study are collected from 1954 Q3 to 2010 Q2. Because our purpose is to examine the question of whether or not NBFIs behave in the same way as banks do after a monetary tightening, the basic setup for handling the data should facilitate a comparison and contrast of banks and NBFIs.

In the FFA, financial intermediaries are divided into 14 groups: Commercial Banking, Savings Institutions, Credit Unions, Property-Casualty Insurance Companies, Life Insurance Companies, Private Pension Funds, State and Local Government Retirement Funds, Government-Sponsored Enterprises, Agency- and GSE-backed Mortgage Pools, Issuers of Asset-Backed Securities (ABS), Finance Companies, Real

[27] Data are available at http://www.federalreserve.gov/releases/z1/Current/data.htm. Also, all FFA data are available via *Data Download Program* (DDP) at the Federal Reserve System.

Estate Investment Trusts (REITs), Security Brokers and Dealers, and Funding Corporations. To facilitate my analysis, I have organized those 14 financial intermediaries into two groups: banks and NBFIs. The category of banks includes depository institutions, which are the first three intermediaries (i.e., commercial banking, savings institutions, and credit unions), while the category of NBFIs incorporates nondepository institutions, which are the remaining 11 financial intermediaries.

I have also created three categories of loans—C&I loans, mortgages, and consumer loans—across banks and NBFIs. Because the FFA provides the balance-sheet data for each of the 14 financial intermediaries, we can identify those three types of loans across these two groups by examining the items on the asset side of each of the 14 balance sheets. For example, to measure the total quantity of consumer loans for banks, I added up all consumer loans on the asset side of the balance sheets for commercial banks, savings institutions, and credit unions. Similarly, to measure the total quantity of consumer loans for NBFIs, I aggregated all consumer loans on the asset side of them for other remaining financial intermediaries. C&I loans and mortgages were aggregated in a similar manner across banks and NBFIs.

2.4.2 Methodology

This study has employed two approaches to measuring the impact of monetary policy on the aggregate loan, the components of loans, and net worth. The first methodology that I have used is a traditional Ordinary Least Squares (OLS) regression model, following the analysis of Kashyap, Stein, and Willcox (1993)—hereafter identified as KSW. Following the analysis of Bernanke and Blinder (1992), I have utilized a vector autoregression (VAR) model as my second methodology.

2.4.2.1 A KSW-Style Approach

To examine the relationship between money and real economic activity, Sims (1972) introduced the concept of *Granger causality* into the debate over the real effects of money in the economy. One variable X is said to Granger-cause Y if and only if the past values of X provide relevant and valuable information sufficient to predict the values of Y. KSW (1993) use this "Granger causality test" to examine the relationship between monetary policy and financial variables—i.e., to see if the past values of monetary policy provide important information to predict the values of financial variables. In other words, the Granger causality test is used to determine whether movements in *monetary policy* help forecast movements in *financial variables*.

Following the analysis of KSW (1993), I employ the Granger-causality tests in two basic ways: a *bivariate* model and a *multivariate* model. In the bivariate specification of equation (2.1), I regress the change in intermediated loans (L) on eight quarterly lags of itself, eight lags of a monetary policy indicator (MP), and a constant. In the multivariate specification of equation (2.2), I add eight lags of the growth of real GDP to equation (2.1) because, according to KSW, the growth of real GDP should be added to the equation "in an effort to control for cyclical factors other than monetary policy which might conceivably affect the financial variables" (1993, p. 86). Specifically, I run the following regression:

$$\Delta L_t = c + \sum_{i=1}^{8} \alpha_i \Delta L_{t-i} + \sum_{i=1}^{8} \beta_i \Delta MP_{t-i} + u_t \quad \cdots\cdots (2.1)$$

$$\Delta L_t = c + \sum_{i=1}^{8} \alpha_i \Delta L_{t-i} + \sum_{i=1}^{8} \beta_i \Delta MP_{t-i} + \sum_{i=1}^{8} \gamma_i \Delta GDP_{t-i} + u_t \quad \cdots\cdots (2.2)$$

These regressions test whether monetary policy Granger-causes financial variables. Such tests equate in fact to determining whether the β_i coefficients equal zero in a regression. For example, in equation (2.1), we want to test whether the past values of monetary policy are useful in forecasting the quantity of loans. If these past values significantly improve the prediction of the loan quantity, we can say that monetary policy Granger-causes the loan quantity. To be precise, in order for monetary policy to Granger-cause the loan quantity, (1) the coefficients on the lags of monetary policy must be statistically different from zero "as a group"—i.e., $\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 \neq 0$—or (2) the significance of the β_i coefficients on the lags of monetary policy must be statistically different from zero "jointly"—i.e., $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 \neq 0$. Therefore, when either of these conditions holds, we can conclude that changes in the stance of monetary policy have some impact on the quantity of loans available in the financial system.

More specifically, I used two null hypotheses to test Granger causality between a monetary-policy variable and the quantity of loans. The first null hypothesis is that the *sum* of the coefficients on the eight lags of monetary policy is zero: $\beta_1 + \beta_2 + \beta_3 + \beta_4 + \beta_5 + \beta_6 + \beta_7 + \beta_8 = 0$. In this case, a *t* test can be used to test the null hypothesis because we have a *simple* hypothesis, for which a "*t* test" approach is appropriate. To test, then, whether the sum of coefficients is zero, we can estimate equation (2.1) or (2.2) in the usual manner with an unrestricted regression. Once the values $\beta_1, \beta_2, \beta_3, \beta_4, \beta_5, \beta_6, \beta_7,$ and β_8 are estimated by OLS, a test of the restriction, or the null hypothesis, can be

conducted by the *t test* in the formula.[28]

The second null hypothesis is that the coefficients of the eight lags of monetary policy are *conjointly* zero: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$. In this case, we can use an "*F* test" to test the null hypothesis because now we have a *joint* hypothesis, for which an *F* test approach is appropriate. To test whether the coefficients on eight lags are conjointly zero, a test of the null hypothesis can be conducted by the *F* test of the formula in the usual way: all lags of the monetary-policy variable are simultaneously excluded from the unrestricted OLS equation (2.1) or (2.2) predicting the quantity of loans.

If this null hypothesis—that is, monetary policy does not help forecast the financial variables—is rejected in the significant level with the calculated *t* statistic or *F* statistic, monetary policy Granger-causes the loan quantity. All empirical results in this study are reported in these two ways—a simple hypothesis and joint hypothesis. In addition to these two ways, a traditional OLS regression with each financial variable is estimated in either a bivariate model or a multivariate model, as shown in equation (2.1) and (2.2). The financial variables applied in this analysis are these: *net worth*, *total intermediary loans*, and the *components of intermediary loans* (i.e., commercial and industry (C&I) loans, mortgages, and consumer loans). In particular, to measure the effect of monetary

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[28] In the simplest case, for example, we can consider two lags rather than 8 lags. Then, we can say that the sum of the two coefficients is zero. That is, the restriction is $\beta_1+\beta_2=0$ instead of $\beta_1+\beta_2+\beta_3+\beta_4+\beta_5+\beta_6+\beta_7+\beta_8 = 0$. A test of restriction can be conducted as follows:

$$t = \frac{(\hat{\beta_1} + \hat{\beta_2}) - (\beta_1 + \beta_2)}{se(\hat{\beta_1} + \hat{\beta_2})} = \frac{(\hat{\beta_1} + \hat{\beta_2}) - 0}{\sqrt{\text{var}(\hat{\beta_1}) + \text{var}(\hat{\beta_2}) + 2\,\text{cov}(\hat{\beta_1}\,\hat{\beta_2})}}$$

where $\beta_1+\beta_2= 0$ under the null hypothesis and where the denominator is the standard error of $(\hat{\beta}_1+\hat{\beta}_2)$. If the calculated *t* value exceeds the critical *t* value at the significant level, the null hypothesis, which proposes that monetary policy does not Ganger-cause the quantity of loans, can be rejected. Also, this *t* test formula can be expanded to the sum of eight coefficients in this analysis.

policy on the components of loans, I estimate equation (2.1) or (2.2), replacing the intermediary-loan variable with the mortgage variable.

In this analysis, the Federal funds rate is used as an indicator of monetary policy.[29] Bernanke and Blinder (1992) assert persuasively that changes in the Federal funds rate are a good indicator of monetary policy. According to their argument, changes in the Federal funds rate measure policy-induced shocks to reserve supply. However, "the funds rate would not be a good measure of monetary actions if its information content stemmed from shocks to reserve demand—arising from changes in the economy—rather than from shocks to reserve *supply*" (Bernanke et al. 1992, p. 914).[30]

All variables except the Federal funds rate take the logged form. All variables, including the Federal funds rate, have been tested for stationarity with the Augmented Dickey Fuller test (ADF), and those variables turned out to have a unit root. Following the KSW, therefore, I determined that all variables are *first-differenced* in order to be transformed into stationary variables, and that 8 lags are applied to the regression.[31]

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[29] Also, Romer's *dummy* variables have been frequently used as an indicator of monetary policy in the literature. Romer and Romer (1989) read the minutes of the FOMC and select some dates as markers of the beginning of an anti-inflationary tightening of monetary policy, or *exogenous shocks*. However, since "Romer dates" are not available after 1988, "Romer dates" are not applicable to the data from 1989 to 2010. Therefore, I have employed only changes in the Federal funds rate as an indicator of the stance of monetary policy in this study.

[30] "For the funds rate to be a good measure of monetary-policy actions, it must be essentially unresponsive to changes in reserve demand within a given month" (Bernanke et al. 1992, p. 914). This means that the supply curve of nonborrowed reserves is extremely elastic at the target federal funds rate. Using both monthly and weekly data, Bernanke et al. (1992) find little effect of reserve demand shocks on the funds rate, which supports the idea that the funds rate is mostly driven by policy decisions.

[31] When 2 lags, 4 lags, and 6 lags are applied to the regression, the result of analysis is not materially different from 8 lags.

2.4.2.2 A VAR Approach

A KSW-Style approach, which was employed in the previous section of this study, has been criticized because it does not distinguish between *endogenous* and *exogenous* monetary-policy actions. *Endogenous* policy actions are the actions of a monetary authority responding systemically to the developments of the economy, while *exogenous* policy actions consist of all other actions of the monetary authority. In order to focus on the independent effect of monetary policy, we need to identify the exogenous monetary-policy shocks.

To identify such exogenous shocks of monetary policy, Bernanke and Blinder (1992) found a variable, the Federal funds rate, whose innovations to the Federal-fund-rate equation can be interpreted as the exogenous shocks in a VAR. Specifically, rather than assuming the entire structure of the economy in detail as in a structural VAR, they employed a recursive VAR to identify the dynamic effects of the exogenous-policy shocks on various macroeconomic variables.[32] As a result, these researchers can measure the true structural response of the economy to exogenous monetary-policy shocks, a response that more accurately reflects the dynamic response of the economy to changes in the Federal fund rate. Examining the responses to a Federal-funds rate shock across financial variables and target macroeconomic variables allows us to "see" the monetary-transmission mechanism open up. Following their analysis, I have employed this recursive VAR model to measure the impact of monetary policy on financial variables.

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[32] In the recursive VAR, it is sufficient to identify one of the following assumptions; (1) there is no feedback from the economy to policy actions within the period, but policy actions affect the macroeconomic variable within the period—according to this assumption, the Federal funds rate is placed *first*—or (2) policy actions affect the macroeconomic variables with "only lags"—according to this assumption, the Federal funds rate is placed *last*.

To demonstrate the identification made by VAR, consider the following as the structure of the economy:

$$Y_t = \sum_{i=1}^{6} B_i Y_{t-i} + \sum_{i=1}^{6} C_i P_{t-i} + u_t \quad \cdots\cdots\cdots\cdots\cdots\cdots (2.3)$$

$$P_t = \sum_{i=0}^{6} D_i Y_{t-i} + \sum_{i=1}^{6} G_i P_{t-i} + v_t \quad \cdots\cdots\cdots\cdots\cdots\cdots (2.4)$$

Y is a vector of nonpolicy variables that capture economic conditions; it includes macroeconomic variables such as real GDP growth, consumer-price index, and other real financial variables. **P** is a vector of policy variables; it includes only the Federal funds rate. The symbols *u* and *v* are *orthogonal* disturbances, which mean that *u* and *v* represent mutually uncorrelated white-noise disturbance in the structure of the economy. The assumption embodied in equations (2.3) and (2.4) is that the current P does not enter the equation (2.3)—that is, that C_0=0—so that the Federal funds rate affects the other macroeconomic variables with *only lags*, but macroeconomic variables affect the Federal funds rate within the period.

This identification assumption is consistent with an ordering in the VARs that the Federal funds rate is placed *last*—especially in a Choleski decomposition of the variance-covariance matrix of the residuals. In particular, depending on the unit of data employed in our analysis, an *identification* assumption can be appropriately chosen. For example, if we use the *annual data* the assumption that monetary policy affects other macroeconomic variables within periods is more plausible. So, we place the policy variable "first." On the other hand, if we use the *monthly data*, or *quarterly data*, the assumption that the actions of monetary authority affect macroeconomic variables with

only lags is more reasonable. So, we place the policy variable "last" (see Walsh 2003). However, regardless of the order of the Federal funds rate, if the residuals correlations turn out low, the impulse-response functions are not sensitive to the ordering of variables (see Enders, 2004).

The VARs are estimated using the quarterly data from these sources: (1) the log of real GDP (RGDP), (2) the log of the consumer-price index (CPI), (3) the log of produce-price index (PPI), (4) the log of real financial variables, and (5) the Federal funds rate (FFR). Financial variables (4) are represented as net worth (NW), intermediary loans (L), commercial and industrial loans (CI), mortgages (M), and consumer loans (CL). I have included the Producer Price Index (PPI) in the VAR in order to resolve the existing "price puzzle" in the literature.

The "price puzzle" refers to an unexpected finding that traditional economic theory would *not* lead us to expect; a tight monetary shock is followed by a rise, rather than a fall, in the price level. Although that effect is small and temporary, the phenomenon seems puzzling. The most common explanation for it is that the variables captured in a *simple* VAR do not spread out to the *full* information set in the real world; that is, the Federal Reserve has better information than the information captured in the VAR. Economists believe that the "price puzzle" arises from imperfect control of Federal-Reserve-held information about future inflation. For this reason, inclusion of commodity or other asset prices in the VAR as an indicator of an expected inflation represents a solution to that problem. To mitigate the "price puzzle," commodity or other asset prices are used in this study as a proxy for the unavailable additional information held by the Federal Reserve.

In the VAR I use in this study, each of the real financial variables—NW, L, CI, M, and CL—is entered into the model. For example, in order to assess the response of *net worth* to monetary policy, I place the variables in the system in this way: RGDP, CPI, PPI, NW, and FFR. Although this four-variable VAR provides a very simple description of the economy, it has advantages of retaining the minimum set of variables necessary for the study without loss of the available data set, and it produces reasonable impulse-response functions.

After all variables—except the Federal funds rate—are seasonally adjusted and are logged, all variables are tested for stationarity for the Augmented Dickey Fuller (ADF) test. All variables are found to be *I* (1); that is, they all contain a unit root. However, Sims (1980) argued that we should not difference the time series data to transform nonstationary variables into stationary variables. The reason is that differencing the data in such a way drops valuable information about the long-term relationship between variables in the system out of the equations. Therefore, in the procedures undertaken in this study, all variables are not differenced. In addition, the lag length in the VAR is determined by two factors: the Alkaike information criterion (AIC) and the final-prediction error (FPE), whose determination was that 6 lags are optimal.[33]

2.5 Empirical Results

This section examines the behavior of banks and NBFIs separately following the shifts of monetary policy because an important question is whether NBFIs behave in the

[33] In EViews, Schwarz Information Criterion (SIC) selects 2 lags, Hannan-Quinn information criterion (HQ) selects 3 lags, and both Alkaike Information Criterion (AIC) and Final Prediction Error (FPE) select 6 lags (see Appendix A). Since 6 lags are mostly selected among different criteria, 6 lags are used in the VAR and reported in this paper. However, the results of the VAR in 2 lags or 3 lags generally demonstrate a result similar to those with 6 lags.

same way as banks do in these kinds of circumstances. As discussed in Section 1.3, the theoretical justification for how monetary policy influences behavior of banks is as follows: A monetary tightening reduces the net worth of banks and NBFIs; the fall of their net worth, in turn, causes the cost of wholesale funds to rise, thus reducing the supply of intermediated loans. So in this empirical test, I first examine the response of the *net worth* of intermediaries to a monetary policy shock; then I investigate the response of the *intermediated loans* to a monetary policy shock.

2.5.1 The Impact of Monetary Policy on the Net Worth of Financial Intermediaries

To test whether monetary policy has a significant impact on the net worth of financial intermediaries, I use the KSW-style methodology described in Section 2.4. From the equations (2.1) or (2.2), I replace an intermediary loan variable (L) with net worth (NW). Specifically, I run this regression:[34] [35]

$$\Delta NW_t = c + \sum_{i=1}^{6} \alpha_i \Delta NW_{t-i} + \sum_{i=1}^{6} \beta_i \Delta MP_{t-i} + u_t \quad \cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots\cdots (2.5)$$

$$\Delta NW_t = c + \sum_{i=1}^{6} \alpha_i \Delta NW_{t-i} + \sum_{i=1}^{6} \beta_i \Delta MP_{t-i} + \sum_{i=1}^{6} \gamma_i \Delta GDP_{t-i} + u_t \quad \cdots\cdots\cdots\cdots (2.6)$$

[34] All variables, like the net worth and real GDP growth, have been transformed into the log form; only the variable that is used as an indicator of monetary-policy remains unchanged. Although we do not difference all of the variables in the VAR model, variables in this OLS model have been differenced so they enter the regressions in stationary form. These variables are log net-worth, the Federal funds rate, log real-GDP growth.

[35] To determine the length of lags, I have looked at three different kinds of the lag tests: Akaike Information Criterion (AIC), Schwarz Information Criterion (SIC), and Hannan-Quinn criterion (HQ) (see Appendix B). In net worth, I report the results produced with 6 lags, which are shown as a baseline specification here. However, I report the results of 8 lags as well, which are chosen in testing the intermediated loans. (Refer to Appendix C for the result of 8 lags). Basically, the results of 8 lags are not materially different from the results produced with 6 lags.

The net worth of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—is entered into equations (2.5) and (2.6). If monetary policy Granger-causes the quantity of net worth, we can infer that monetary policy has some impact on the net worth of each group.

Table 2.3 reports the results of equations (2.5) and (2.6), which represent bivariate model and multivariate models individually across groups. In the *t* test approach, entries in the β_i *sum* report the sum of the β_i coefficients from each regression, and the parenthesis shows the *t* statistic for the test of the sum. In this case, a large *t* value, one exceeding the critical *t* value, indicates that the sum of the β_i coefficients is more reliable, and that the monetary-policy variable is important for predicting the behavior of net worth. In the *F* test approach, the entries in the *exclusion* report the marginal significance levels, or *p value*, from the hypothesis that all eight lags of the monetary-policy variable can be excluded from the equation predicting the net worth of intermediaries. In this instance, a small *p* value indicates that movements in monetary

Table 2.3 Responses of Net Worth

	Total Financial Institutions		Banks		NBIFs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Net Worth (bivariate)	−0.026*** (4.12)	0.0009***	−0.030*** (2.60)	0.0071***	−0.027*** (3.39)	0.0048***
Net Worth (multivariate)	−0.035*** (4.95)	0.0000***	−0.044*** (3.20)	0.0087***	−0.031*** (3.51)	0.0004***

Notes: In the bivariate model, the net worth of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—is regressed against a constant, 8 lags of itself, and 8 lags of a monetary policy indicator (MP). In the multivariate model, 8 lags of GDP are added to the regression. All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5 %, and 1%, respectively.

policy help forecast movements in net worth.

Under the theoretical justifications provided in Section 1.3, we would expect the net worth of financial intermediaries to decrease in response to a monetary tightening. The results are strongly consistent with such a theoretical explanation. As shown in Table 2.3, β_i *sum* entries indicate that the net worth of total financial institutions—banks and NBFIs—decreases after a positive shock in the Federal funds rate in either the bivariate or multivariate model. After 1% increase in the Federal funds rate, banks decrease their net worth by 3% and NBFIs decrease by 2.7% in the bivariate model. Note that tight monetary policy has a somewhat stronger impact on the net worth of banks than on that of NBFIs: the β_i *sum* for banks is −0.030 in the bivariate model and −0.044 in the multivariate model; for NBFIs the β_i *sum* is −0.027 in the bivariate model, and −0.031 for the multivariate model. The *t* values for those β_i *sums* are statistically significant at the 2% level. All of these results are consistent with the theoretical explanation in Section 2.3.

In addition, the *exclusion* entries show the joint significance of the β_i coefficients for the null hypothesis that all lags of monetary policy do *not* have a predictive power for the variable of *net worth*. Surprisingly, all the null hypotheses are rejected as statistically significant at the 2% level. In general, an *F* value approach shows results similar to those of a *t* value approach at the statistically significant 2% level.

As we would expect, the behavior of aggregate data from total financial institutions is not much different from the behaviors of disaggregate data from banks or NBFIs. That is, for *total* financial institutions, the behavior of net worth declines following a monetary tightening at the statistically significant 2% level: the β_i *sum* is −0.026 for the

bivariate model, and −0.035 for the multivariate model. Interestingly, the aggregate data show statistically higher *t* values than do disaggregate data. For *total* financial institutions, the *t* vales are 4.12 for the bivariate model and 4.95 for the multivariate model. For *bank*, the *t* values are 2.60 for the bivariate model and 3.20 for the multivariate model. For *NBFIs*, the *t* values are 3.39 for the bivariate model and 3.51 for the multivariate model. All these results are consistent with the theoretical prediction made in Section 2.3 that monetary policy affects the net worth of banks and NBFIs both.

Alternately, I used the VAR methodology for this test. Figure 2.6 shows the behavior of net worth—total financial institutions, banks, and NBFIs, respectively—in response to a one-standard deviation shock to the Federal funds rate. The VAR methodology produces very similar results to those of the KSW-Style methodology: The net worth of each group reduces significantly after a monetary contraction. Consistent with the previous results, tight monetary policy impacts the net worth of banks more strongly than that of NBFIs. The impact of a monetary-policy shock reaches its lowest level after approximately 12 quarters: −0.023 for total financial institutions, −0.043 for banks, and −0.014 for NBFIs. Although a monetary policy shock influences banks and NBFIs in the same direction, as shown in Figure 2.6, the strength of impact shows that the trough of net worth is three times as deep for banks as it is for NBFIs.

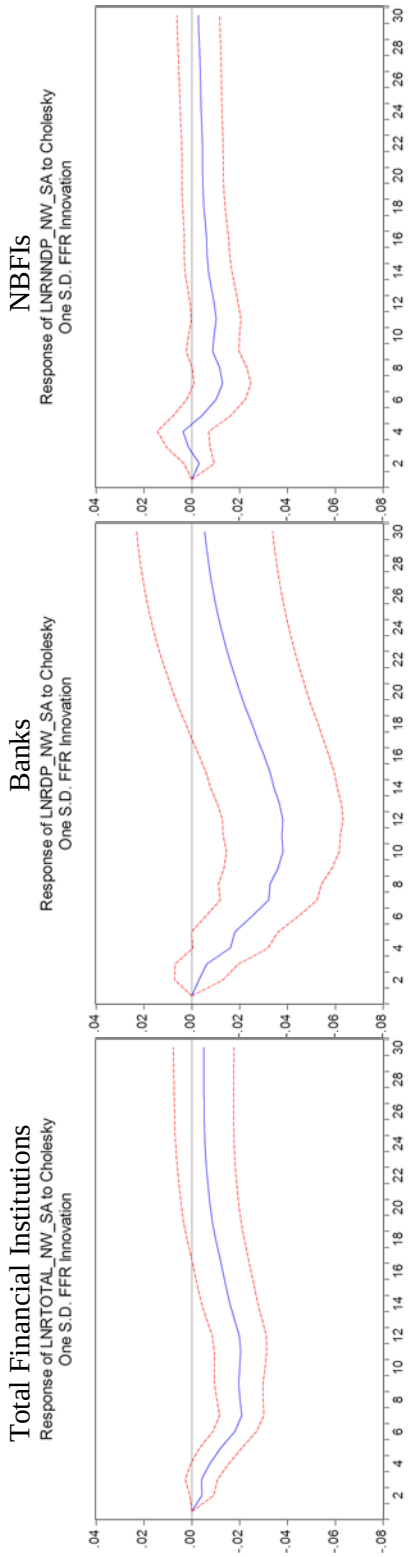

Figure 2.6 Responses of Net Worth

2.5.2 The Impact of Monetary Policy on the Loans of Financial Intermediaries

In this subsection, equations (2.1) and (2.2) from Section 2.4 are employed to test the theoretical arguments that all financial intermediaries reduce their supply of available loans after a monetary tightening.[36, 37]

The loans of *total financial institutions, banks,* and *NBFIs,* respectively, are entered in each of the equations (2.1) and (2.2). In this case, not only aggregated loans but also components of loans—i.e., commercial and industrial (C&I) loans, mortgages, and consumer loans—are regressed in the equations to examine the behavior of different components of loans. By using both the bivariate and the multivariate models, equation results are produced and are then reported in Table 2.4 and 2.5. Those results are reported in terms of different types of groups (in columns) and different types of loans (in rows). As in Table 2.4, the β_i *sum* entries indicate the sum of coefficients within eight lags of each monetary-policy indicator, as well as the associated *t* statistic, and the *exclusion* entries indicate the result of the exclusion test.

According to the theoretical justifications presented in Section 2.3, we would expect the supply of intermediated loans to decline in response to a monetary shock. We can examine the response of intermediated loans in two ways: the behavior of groups and

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[36] All variables are logged, excluding the variable used as an indicator of monetary policy. In the same way as in the equations (5) and (6), all variables —such as log loans, the Federal funds rate, and log-real GDP—have been differenced so they enter the regressions in the stationary form.

[37] In the same way as before, I examine three kinds of the lag tests: AIC, SIC, and HQ (see Appendix D). Although all three criteria have chosen 2 lags as an optimum number of lags, it might be difficult for 2 quarters to capture the dynamic effects of monetary policy shocks to the quantity of loans. In the literature, the previous researchers—Kashyap et al. (1993) and Onliner & Rudebusch (1995, 1996)—have typically employed 8 lags in their empirical studies. Also, as we see Appendix D, all three kinds of tests show a noticeable tendency to decrease at 8 lags. Thus the previous researchers chose 8 lags instead of 2 lags. In this subsection, I report the results of 8 lags. However, the results of 2 lags and 6 lags are also reported in the Appendix E to make comparisons among them (see Appendix E).

Table 2.4 Bivariate Model

	Total Financial Institutions		Banks		NBFIs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Total Loans	−0.006***	0.0773*	−0.009***	0.0113***	−0.001	0.6753
	(3.27)		(3.91)		(0.82)	
C & I Loans	−0.001	0.6376	−0.001	0.2317	−0.001	0.884
	(0.47)		(0.30)		(0.14)	
Mortgages	−0.004***	0.0002***	−0.007***	0.0002***	−0.001	0.3198
	(2.93)		(3.76)		(0.55)	
Consumer Loans	−0.005**	0.0644*	−0.019***	0.0062***	0.009	0.3837
	(2.21)		(4.28)		(1.36)	

Notes: In the bivariate model, aggregate loans (or components of loans) of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—are regressed against a constant, 8 lags of itself, and 8 lags of a monetary policy indicator (MP). All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Table 2.5 Multivariate Model

	Total Financial Institutions		Banks		NBFIs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Total Loans	−0.005***	0.0302**	−0.007***	0.0181***	−0.002	0.5351
	(2.86)		(3.16)		(1.00)	
C & I Loans	0.002	0.1648	0.004	0.03**	0.005	0.6843
	(0.66)		(0.08)		(1.10)	
Mortgages	−0.004***	0.0012***	−0.007***	0.0014***	−0.002	0.1722
	(2.69)		(3.25)		(1.21)	
Consumer Loans	−0.005**	0.1361	−0.012***	0.2193	0.005	0.1219
	(2.00)		(2.39)		(0.73)	

Notes: In the multivariate model, aggregate loans (or components of loans) of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—are regressed against a constant, 8 lags of itself, 8 lags of a monetary policy indicator (MP), and 8 lags of GDP. All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

the behavior of loan components. First, we can consider the behavior of each group—total financial institutions, banks, and NBFIs. As indicated in the first row of Tables 2.4 and 2.5, both banks and NBFIs reduce the supply of *total available loans* after a monetary tightening. Notice that banks reduce this quantity significantly more than NBFIs do in response to a monetary tightening, though the reduction is not statistically significant for NBFIs. So the β_i *sum* for *banks* is −0.009 according to the bivariate model and −0.007 according to the multivariate model; and the β_i *sum* for *NBFIs* is −0.001 according to the bivariate model and −0.002 according to the multivariate model. The *t* values for banks are statistically significant at the 2% level, whereas the *t* values for NBFIs are statistically insignificant.

Additionally, the *exclusion* entries show results similar to the β_i *sum* entries. As already indicated, the marginal-significance levels of banks are statistically significant at the 2% level, while those of NBFIs are statistically insignificant. Notice that a decrease in the supply of loans of *total* financial institutions is statistically significant at the 2% level. Specifically, for total financial institutions, the β_i *sum* is −0.006 in the bivariate model and −0.005 in the multivariate model at the 2% significant level of *t* values. The marginal significance level of *exclusion* entries is statistically significant at the 10% and 5% level for the bivariate and the multivariate model, respectively.

Second, together with the behavior of each group, I examine the behaviors of the components of the loans—i.e., C&I loans, real-estate loans, and consumer loans. As shown in Table 2.4 and 2.5, rows 2-4, the loan-component behaviors are somewhat less uniform, even though the behavior of total loans is always consistent in the predicted direction at the statistically significant level. For banks and total financial institutions,

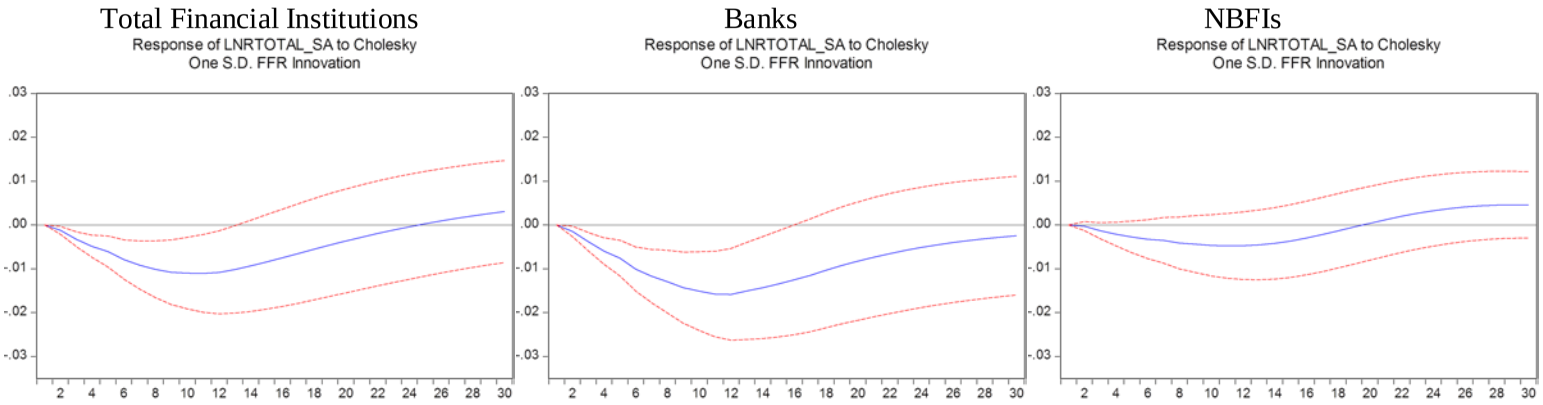
the response of total loans, mortgages, and consumer loans displays significant declines at the statistically significant level—in both the bivariate and the multivariate model. However, the responses of C&I loans *decrease* in the bivariate model, but they *increase* in the multivariate model in a statistically insignificant way.[38] In addition, although the responses of the aggregate-loan behaviors are overall significant, some responses of the component-loan behaviors are statistically insignificant. However, these results may reflect the fact that each financial institution manages its total quantity of loans more intensively, rather than individual component loans, in response to the monetary policy shocks. For NBFIs, the responses of the loan components are mixed in a statistically insignificant way: They are positive or negative depending on the models we select. Nonetheless, the response of total loans for those NBFIs is always the same, with negative reactions. In general, the *t* values, or marginal-significance levels, are statistically *significant* for banks, whereas they are statistically *insignificant* for NBFIs overall.

In the similar way as I did in the net worth, I used the VAR methodology for these empirical tests. Figure 2.7 shows the behavior of total loans and the behavior of the loan components—total financial institutions, banks, and NBFIs, respectively—in response to one standard-deviation shock to the Federal funds rate.

The VAR methodology, in general, produces similar results to those produced by the KSW-style methodology. Following monetary tightening, the quantity of total loans and the components of loans declines significantly, except for C&I loans; in fact, C&I

[38] The increase of C&I loans in the multivariate model is consistent with the empirical studies of previous researchers—such as Bernanke and Gertler (1995) and den Haan, Sumner, and Yamashiro (2007)—as well as the VAR in the following section.

* Total Loans



* C&I Loans

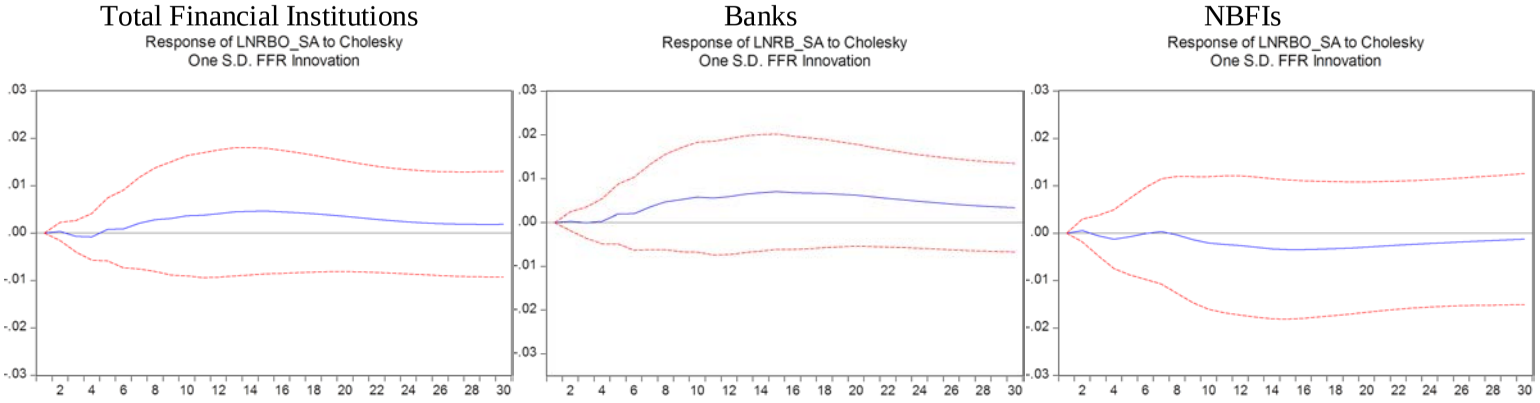
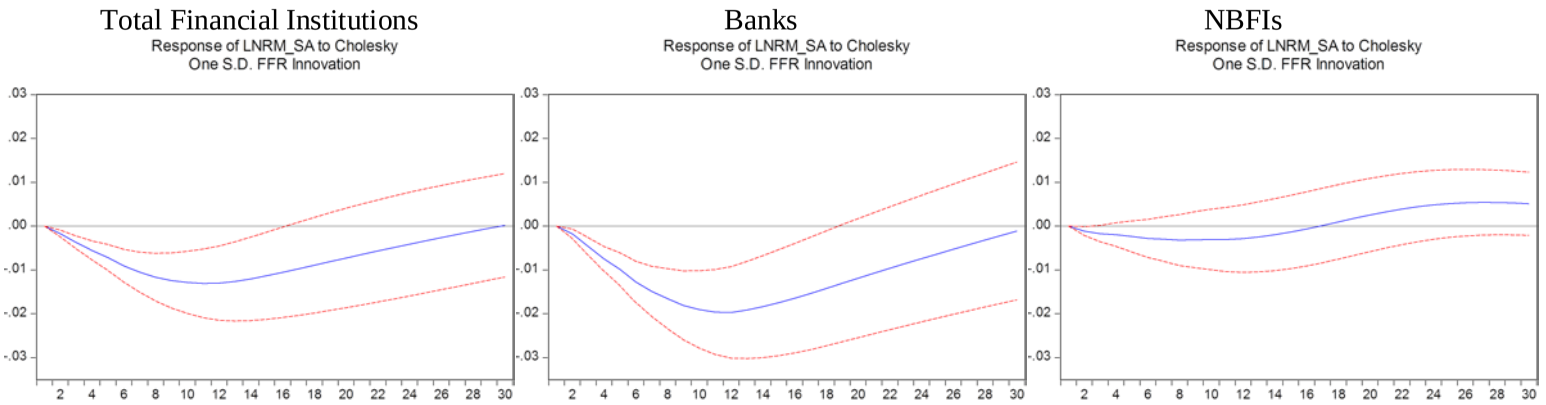


Figure 2.7 Responses of Total Loans, C&I Loans, Mortgages, and Consumer Loans

* Mortgages



* Consumer Loans

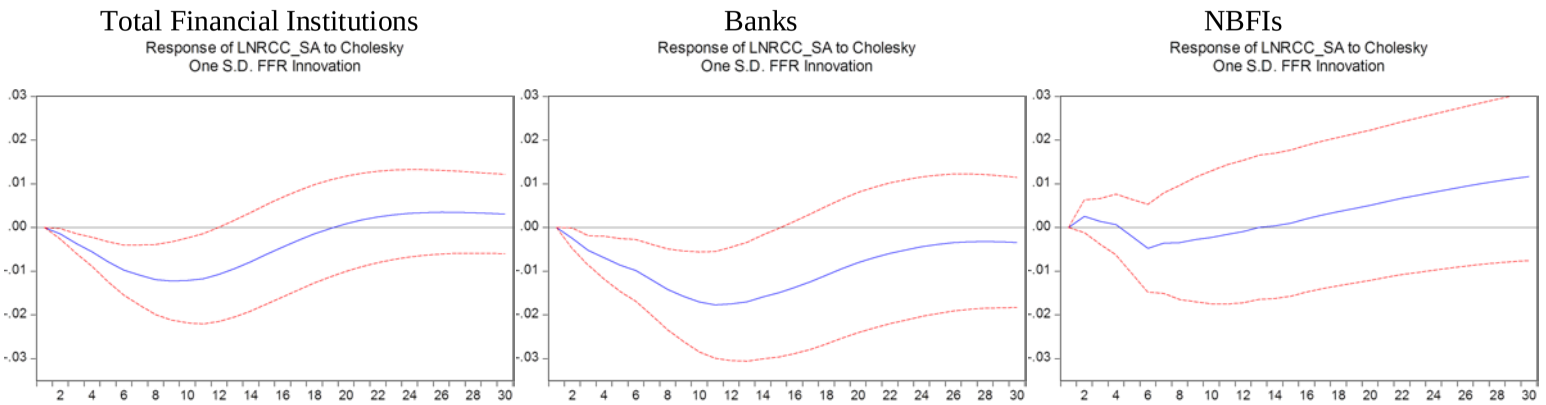


Figure 2.7 Continued

loans increase in the opposite direction from the one taken by other components.[39] Furthermore, we observe that, consistent with the previous OLS regressions, the impact of monetary policy on total loans is stronger on *banks* than on NBFIs. More specifically, the impulse-response functions show that the quantity of total loans bottoms out after 12 or 13 quarters—that point being –0.13 for total financial institutions, −0.17 for banks, and −0.08 for NBFIs. That quantity returns to its original level 24, 30 or 18 quarters after the initial shock.

We can observe other interesting facts from a careful reading of Figure 2.7. First, the behavior of C& I loans is similar to the results we obtained with the multivariate model rather than with the bivariate model. The aggregated C&I loans undergo a long-range increase in response to the shock of monetary tightening: the C&I loans of banks immediately increase, reaching a peak 15 quarters after the initial shock; the C&I loans of NBFIs decrease, initially, but then increase and continue to increase up to 11 quarters after the original shock.

Second, the behavior of mortgages the VAR provides is consistent with the behavior of mortgages in the previous two OLS models. A monetary shock impacted these kinds of loans much more strongly for banks than it impacted them for NBFIs—the trough for banks is four times deeper than the trough for NBFIs.

Third, the VAR-revealed behavior of the consumer loans of banks is consistent with

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[39] The increase of C&I loans is parallel to Bernanke and Gertler (1995) and Den Haan, Sumner, and Yamashiro (2007). Bernanke and Gertler (1995) mention that the "perverse" increase of C&I loans might be explained by the buildup of firms' inventories to finance the cost of inventories during the period of tight money, which is an explanation of *demand side*. But, Den Haan, Sumner, and Yamashiro (2007) could not find the evidence to support Bernanke and Gertler's explanation. Alternatively, Den Haan et al. (2007) suggested that banks may change their portfolio of loans to manage their risk. In other words, to the extent that banks consider the long-term mortgages to be riskier than the short-term C&I loans, banks might substitute their portfolios from the long-term mortgages into the short-term C&I loans after a monetary tightening, which is an explanation of *supply side*.

the consumer-loan behavior of banks we saw in the previous two OLS models, but compared with those models, the consumer-loan behavior of NBFIs provided us by the VAR is somewhat ambiguous. In both the OLS and the VAR methodology, as to *banks*, the consumer loans decrease subsequent to a monetary policy shock. On the other hand, as to *NBFIs*, the previous two OLS models show that the consumer loans increase, but the VAR indicates that the consumer loans does not show a clear pattern—that is , they undergo a slight increase, decrease slightly in an S-shape, then increase and continue increasing for the next 6 quarters.

Overall, we see that the behavior of banks, or total financial institutions, is consistent with what we saw in the previous two models, whereas the VAR-indicated behavior of NBFIs is somewhat less consistent with the same behavior revealed in the previous two models.

2.6 Some Supplementary Tests for Loans for NBFIs

In the previous subsection, NBFIs' net worth declines at the statistically significant level in response to contractionary monetary policy; however, NBFIs reduce their aggregate debt and components of debt at the statistically insignificant level even though they generally move in the same direction with banks. To address this issue, I conduct some supplementary tests to examine the responses of NBFIs to two different shocks: (1) a new measure of monetary shocks and (2) shocks to bank lending standards. Romer and Romer (2004) introduced a new measure of monetary policy shocks that is exempt from endogenous and anticipatory movements to large extent, compared to conventional measures. Lown, Morgan, and Rohatgi (2000) and Lown and Morgan (2002, 2006) used a measure of bank lending standards that are gathered by the Federal

Reserve when they forecast loan growth and output.

2.6.1 A New Measure of Monetary Policy Shocks

In the previous section, we have used the nominal federal funds rate as an indicator of monetary policy. The federal funds rate has become the standard indicator of monetary policy in the literature. However, although the federal funds rate is generally a good measure of exogenous policy shocks, it is still subject to the problem of endogeneity. According to Romer and Romer (2004), changes in the federal funds rate are still contaminated by its *endogenous movements* to economic condition and its *anticipatory movements* by the Fed—i.e., the Fed's reactions to the state of the economy.[40]

2.6.1.1 A Problem with the Conventional Measure

First, the federal funds rate that is conventionally used is contaminated by its endogenous movements to economic conditions. For example, the funds rate rise during an expansion when demand for credit increases, as the Fed accommodates to the increased demand for credit. Similarly, the funds rate falls during a contraction when demand for credit decreases, the Fed adjusts to the decreased demand of credit. Since such endogenous movements generate a positive relationship between the funds rate and the amount of credit, they may lead scholars to underestimate the negative relationship between monetary policy actions and real economic variables. Particularly, during an era in the late 1970s when the Fed did not target the funds rate, endogenous problems were likely to be more pronounced than the Greenspan and Bernanke eras

[40] In a broad sense, the problems of both endogenous movements and anticipatory movements can be classified into the problem of endogeneity.

when the Fed targeted the funds rate.

Second, the federal funds rate is also contaminated by its anticipatory movements engineered by the Fed. The Fed devotes a great deal of resources to the forecasts of the possible performance of output, prices, and unemployment. By using these forecasts, the Fed frequently influences the funds rate in anticipation of the future economic conditions. As a result, movements in the funds rate are frequently reactions to information about future economic conditions, exhibiting the Fed's endogenous movements. For example, the Fed is likely to cut the funds rate when it perceives a sign of a recession in the economy. In this situation, although the Fed reduces the funds rate substantially, credit is not likely to increase at this time. Nonetheless, such an action may mitigate the severity of the recession; otherwise, we would have had a worse recession. If such anticipatory countercyclical actions are regular, a regression may fail to find a negative relationship between increases in the funds rate and loan growth even if such a relationship in fact exists (Romer & Romer, 2004).

2.6.1.2 The Derivation of a New Measure of Monetary Shocks

To address the problems, Romer and Romer (2004) derived a new measure of monetary policy shocks that are free of the problems of endogenous and anticipated movement. Such a new measure is obtained in the following procedures. The first procedure is to derive a series on intended funds rate changes around the time of the meetings of the Federal Open Market Committee (FOMC). For the sample period of 1966 Q1 to 1996 Q4, Romer and Romer (2004) read both quantitative records, which are *Weekly Report of the Manager of Open Market Operations*, and narrative accounts of each FOMC meeting, which is the *Record of Policy Actions of the Federal Open*

Market Committee.[41] By using the information about the quantitative and narrative records, they were able to keep track of changes in the Fed's intended-funds rate. The resulting series on intended-funds-rate changes eliminates some short-term endogenous movements between the funds rate and the economic conditions and short-term noises—i.e., fluctuations of the funds rate from day to day.

Although the first procedure circumvents endogenous movements and noises to some extent, the series (on intended-funds-rate changes) is still subject to the problems of the Fed's anticipatory movements—i.e., the Fed's reaction to the state of the economy. The Fed frequently changes the target funds rate in expectation of *future* economic development. In particular, the Fed makes use of internal forecasts of inflation and economic activity around each FOMC meeting and responds to information about future economic developments.

The second procedure, therefore, is to eliminate the Fed's anticipatory movements from the intended funds rate changes around the time of the meetings of the FOMC. For the FOMC decisions, the Fed makes use of internal forecasts, which are referred to as the *Greenbook* forecasts that are prepared by the staff of the Fed before each meeting of the FOMC. Romer and Romer (2004) used the *Greenbook* forecasts as a proxy for policymakers' information about future economic developments—i.e., what will happen to prices, output, and unemployment. They take the regression of the intended funds rate changes around the time of the meetings of the FOMC on the *Greenbook*

[41] *Record of Policy Actions of the Federal Open Market Committee* provides summaries of FOMC discussions. More detailed accounts are contained in the *Minutes of Federal Open Market Committee* and later renamed the *Transcripts of Federal Open Market Committee* in 1993.

forecasts.[42] "The residuals from this regression show changes in the intended funds rate not taken in response to information about future economic developments. The resulting series for monetary shocks should be relatively free of both endogenous and anticipatory actions."(Romer and Romer, 2004, p. 1056)

2.6.1.3 Empirical Results

For the sample periods from 1966 Q1 to 1996 Q4, I reestimate equations (2.3) and (2.4) using a new measure series in place of the nominal federal funds rate. These sample periods are employed because a new measure of monetary policy shocks is available only for such sample periods. For the same sample periods, I also reestimate the same regression using the nominal federal funds rate. The comparisons of the new measure and the conventional measure can show whether the new measure produces results that differ in important ways from those based on the conventional measure.

Figure 2.8 shows the response of total loans and components of loans (i.e., C&I loans, mortgages, and consumer credit) to one standard deviation innovation in the Romers' shocks. The total loans of banks fall sharply through quarter 9 by 2.3% and then reach their initial level at quarter 23. However, the total loans of NBFIs decline

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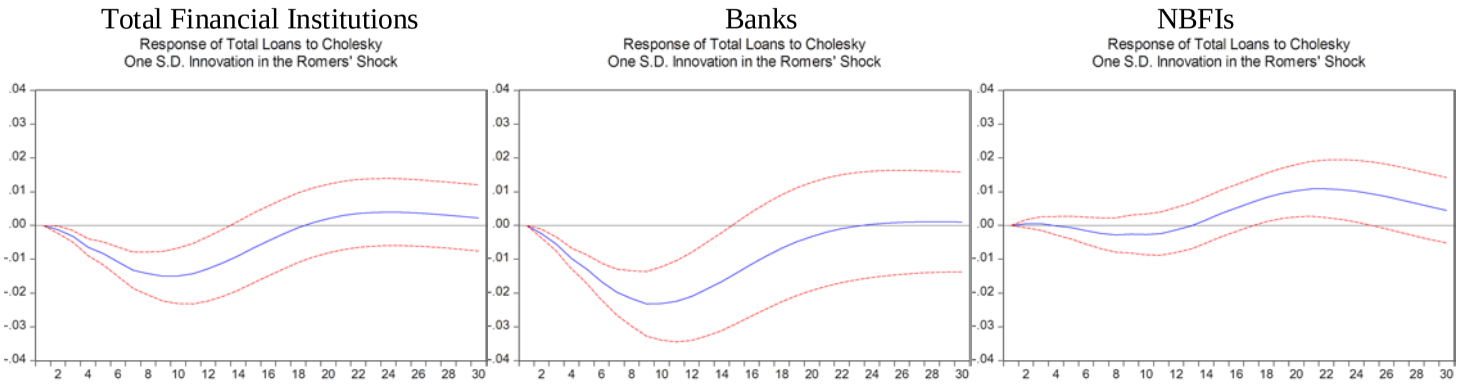
[42] In the second procedure, the specific equation that Romer and Romer (2004) estimate is:

$$\Delta ff_m = \alpha + \beta ffb_m + \sum_{i=-1}^{2} \gamma_i \Delta\tilde{y}_{mi} + \sum_{i=-1}^{2} \lambda_i\left(\Delta\tilde{y}_{mi} - \tilde{y}_{mi-1,\ i}\right) + \sum_{i=-1}^{2} \varphi_i \tilde{\pi}_{mi} + \sum_{i=-1}^{2} \theta_i\left(\Delta\tilde{\pi}_{mi} - \Delta\tilde{\pi}_{mi-1,\ i}\right) + \rho\tilde{u}_{mo} + \varepsilon_m.$$

"Δff_m is the change in the intended funds rate around FOMC meeting m. *ffb_m* is the level of the intended funds rate before any changes associated with meeting m. It is included to capture any tendency toward mean reversion in FOMC behavior. $\tilde{\pi}, \Delta\tilde{y}$, and $\tilde{u}$ refer to the forecasts of inflation, real output growth, and the unemployment rate. Both the forecasts for the contemporaneous meeting and the change in the forecast since the previous meeting are included because it is plausible that both the levels and the changes in the forecasts are important determinants of Federal Reserve behavior. The *i* subscripts refer to the horizon of the forecast: –1 is the previous quarter; 0 is the current quarter; and 1 and 2 are one and two quarters ahead, respectively" (Romer and Romer, 2004, p. 1061).

* Total Loans



* C&I Loans

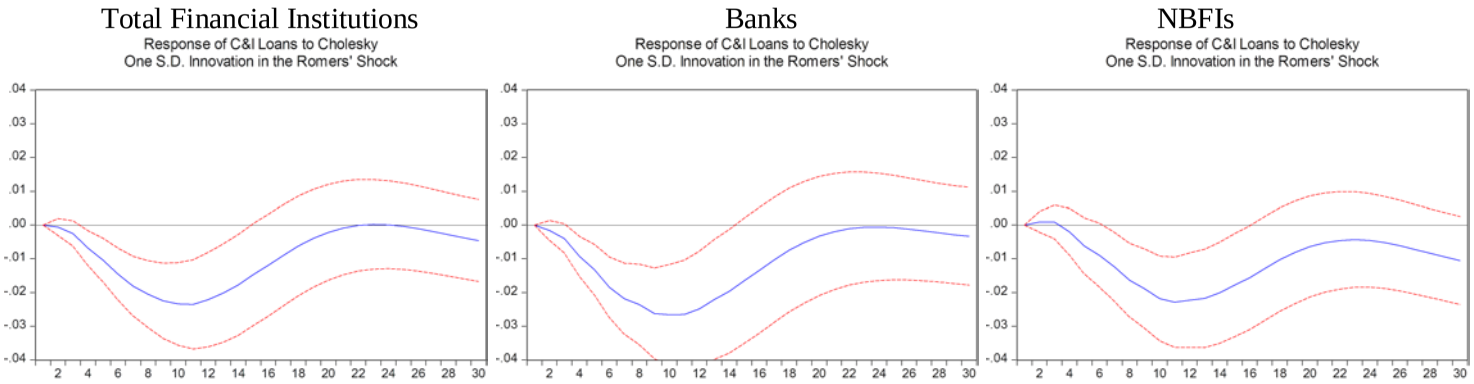


Figure 2.8 Responses of Total Loans, C&I Loans, Mortgages, and Consumer Credit to a One S.D. a New Measure Innovation Sample Periods: 1966 Q1 ─ 1996 Q4

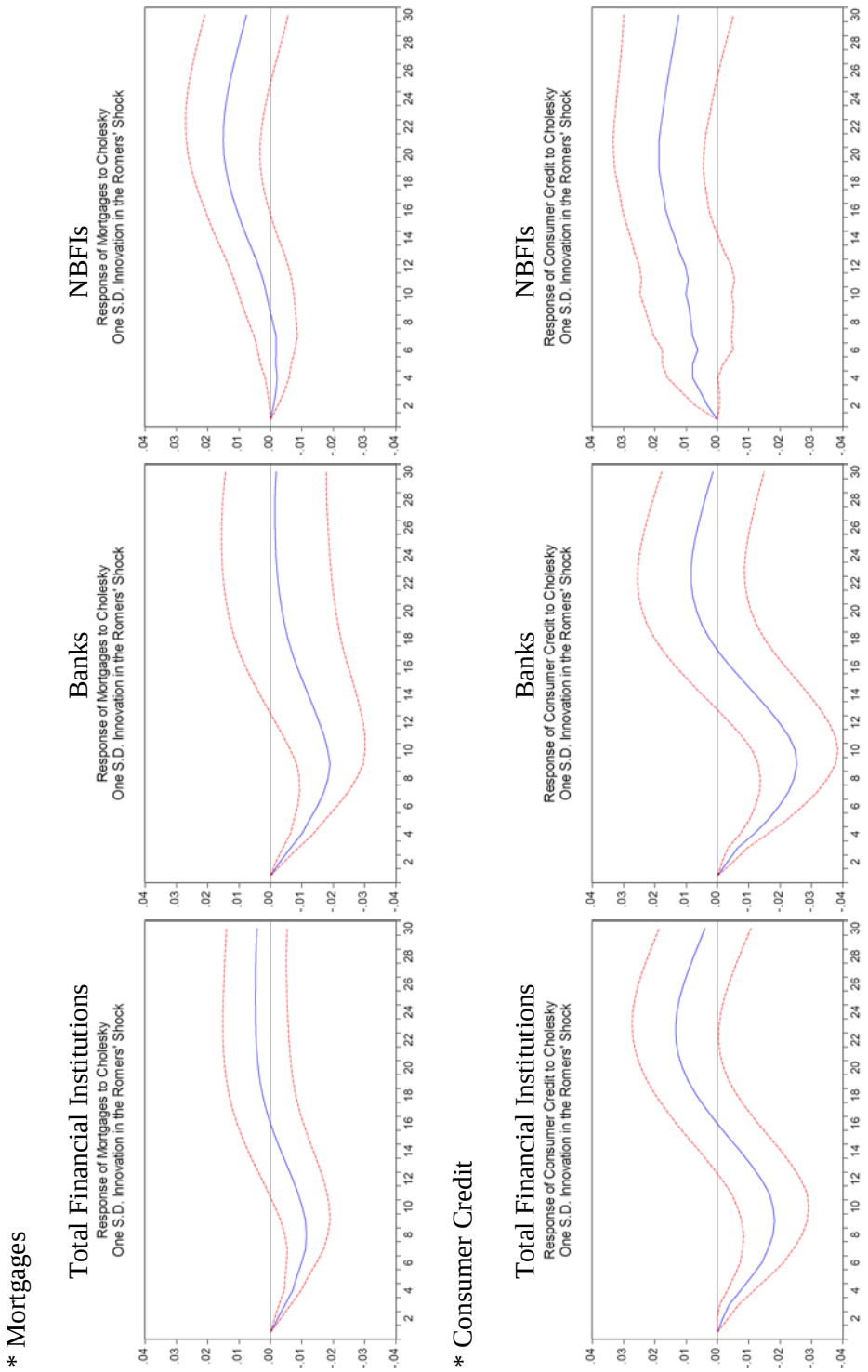


Figure 2.8 Continued

* Romers' Shock

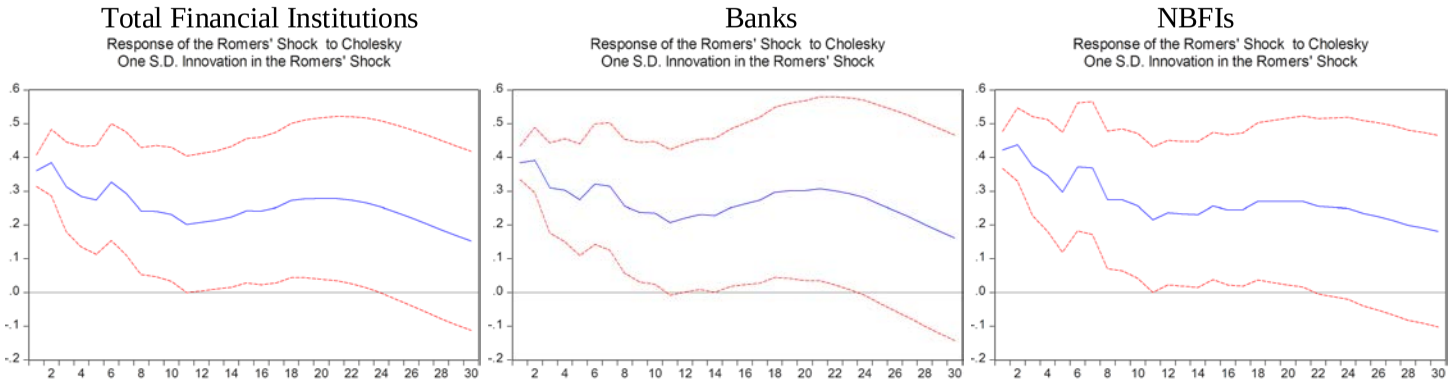


Figure 2.8 Continued

sluggishly through quarter 8 by 0.3% and then continuously increase through quarter 22; after that, they finally decline. The *t* values of total loans are over 2 between quarters 2 and 14 and between quarters 18 and 25 for banks and NBFIs, respectively (see Table 2.6).

The C&I loans show a similar pattern between banks and NBFIs. The C&I loans of banks and NBFIs fall sharply and reach their trough around quarter 10 and then recover. The *t* value of C&I loans are over 2 between quarter 4 and 14 and between quarters 7 and 16 for banks and NBFIs, respectively (see Table 2.7 and 2.8).

Unlike C&I loans, mortgages and consumer credit exhibit somewhat different pattern between banks and NBFIs. Banks sharply *decrease* both mortgages and consumer credit by around quarter 10 and then increase them. The *t* values of mortgages and consumer credit are over 2 between quarter 2 and 12 both of loans for banks (see Table 2.7). In contrast to banks' responses to mortgages and consumer loans, NBFIs *increase* these loans. NBFIs initially slowly decrease mortgages and then increase for quite a while, which shows a very similar pattern with their total loans. Interestingly, NBFIs steadily increase consumer credit through the quarter 20 by reaching its peak and then start to fall gradually. The *t* values of mortgages and consumer credit are over 2 between quarter 16 and 25 and quarter 15 and 25, respectively (see Table 2.8).

In general, the results of estimates have shown that the responses of both banks and NBFIs are statistically significant at some time periods. The responses of banks are statistically significant over the first half periods (i.e., periods between quarter 2 and 14), while the responses of NBFIs are statistically significant over the middle and later periods (i.e., periods between quarter 7 and 25). Such different patterns of the *t* values

Table 2.6 The Impact of New Monetary Policy Shocks on Total Loans

Banks				NBFIs			
Period	Point prediction	Standard error	*t* value	Period	Point prediction	Standard error	*t* value
1	0	0		1	0	0	
2	-0.0024	0.0007	-3.72	2	0.0005	0.0006	0.85
3	-0.0056	0.0010	-5.36	3	0.0006	0.0010	0.54
4	-0.0098	0.0015	-6.36	4	-0.0001	0.0014	-0.07
5	-0.0129	0.0021	-6.09	5	-0.0006	0.0017	-0.38
6	-0.0167	0.0027	-6.10	6	-0.0015	0.0020	-0.76
7	-0.0197	0.0034	-5.80	7	-0.0023	0.0023	-1.02
8	-0.0216	0.0041	-5.29	8	-0.0028	0.0025	-1.10
9	-0.0232	0.0048	-4.85	9	-0.0025	0.0028	-0.90
10	-0.0231	0.0055	-4.24	10	-0.0027	0.0030	-0.88
11	-0.0224	0.0060	-3.72	11	-0.0024	0.0032	-0.75
12	-0.0210	0.0065	-3.22	12	-0.0013	0.0033	-0.39
13	-0.0188	0.0069	-2.72	13	-0.0001	0.0034	-0.04
14	-0.0166	0.0073	-2.29	14	0.0017	0.0034	0.48
15	-0.0140	0.0075	-1.87	15	0.0036	0.0035	1.04
16	-0.0114	0.0077	-1.48	16	0.0052	0.0035	1.49
17	-0.0090	0.0078	-1.15	17	0.0068	0.0035	1.93
18	-0.0067	0.0079	-0.85	18	0.0083	0.0036	2.31
19	-0.0048	0.0080	-0.60	19	0.0095	0.0037	2.54
20	-0.0032	0.0080	-0.40	20	0.0103	0.0039	2.66
21	-0.0019	0.0080	-0.24	21	0.0108	0.0041	2.66
22	-0.0009	0.0080	-0.12	22	0.0109	0.0043	2.55
23	-0.0002	0.0079	-0.03	23	0.0106	0.0044	2.39
24	0.0003	0.0079	0.04	24	0.0101	0.0046	2.21
25	0.0007	0.0078	0.09	25	0.0094	0.0047	2.00
26	0.0009	0.0077	0.12	26	0.0086	0.0048	1.78
27	0.0011	0.0076	0.14	27	0.0076	0.0049	1.56
28	0.0011	0.0075	0.15	28	0.0065	0.0049	1.34
29	0.0011	0.0074	0.15	29	0.0055	0.0049	1.13
30	0.0010	0.0074	0.14	30	0.0045	0.0049	0.92

Notes: The (adjusted) sample period is 1967 Q3– 1996 Q4. In each period, the *t* value is calculated by dividing the point prediction by the standard error.

Table 2.7 The Impact of New Monetary Policy Shocks on Components of Loans (Banks)

Banks						
	C&I Loans		Mortgages		Consumer Credit	
Period	Point prediction	*t* value	Point prediction	*t* value	Point prediction	*t* value
1	0		0		0	
2	-0.0016	-1.08	-0.0030	-4.52	-0.0032	-3.72
3	-0.0040	-1.83	-0.0064	-5.27	-0.0064	-4.22
4	-0.0093	-3.13	-0.0099	-5.49	-0.0116	-5.33
5	-0.0132	-3.53	-0.0124	-5.00	-0.0161	-5.41
6	-0.0185	-4.10	-0.0150	-4.74	-0.0197	-5.21
7	-0.0219	-4.15	-0.0170	-4.39	-0.0226	-4.94
8	-0.0236	-3.94	-0.0184	-4.00	-0.0245	-4.54
9	-0.0263	-3.89	-0.0190	-3.58	-0.0254	-4.12
10	-0.0266	-3.57	-0.0183	-3.07	-0.0248	-3.63
11	-0.0265	-3.29	-0.0171	-2.63	-0.0228	-3.06
12	-0.0249	-2.91	-0.0156	-2.22	-0.0197	-2.49
13	-0.0221	-2.48	-0.0138	-1.87	-0.0161	-1.95
14	-0.0197	-2.14	-0.0120	-1.56	-0.0122	-1.43
15	-0.0165	-1.78	-0.0102	-1.28	-0.0082	-0.94
16	-0.0134	-1.44	-0.0084	-1.03	-0.0042	-0.48
17	-0.0103	-1.11	-0.0068	-0.82	-0.0006	-0.06
18	-0.0074	-0.81	-0.0055	-0.66	0.0025	0.29
19	-0.0052	-0.57	-0.0045	-0.52	0.0049	0.57
20	-0.0033	-0.37	-0.0036	-0.42	0.0067	0.77
21	-0.0020	-0.23	-0.0029	-0.34	0.0078	0.91
22	-0.0010	-0.13	-0.0024	-0.28	0.0084	0.98
23	-0.0006	-0.08	-0.0020	-0.23	0.0084	0.99
24	-0.0006	-0.08	-0.0017	-0.20	0.0080	0.95
25	-0.0008	-0.10	-0.0015	-0.18	0.0073	0.87
26	-0.0012	-0.16	-0.0014	-0.17	0.0063	0.76
27	-0.0017	-0.23	-0.0013	-0.16	0.0052	0.63
28	-0.0023	-0.31	-0.0014	-0.17	0.0040	0.49
29	-0.0029	-0.39	-0.0015	-0.19	0.0028	0.33
30	-0.0033	-0.45	-0.0018	-0.22	0.0015	0.18

Notes: The (adjusted) sample period is 1967 Q3– 1996 Q4. In each period, the *t* value is calculated by dividing the point prediction by the standard error.

Table 2.8 The Impact of New Monetary Policy Shocks on Components of Loans (NBFIs)

NBFIs						
	C&I Loans		Mortgages		Consumer Credit	
Period	Point prediction	*t* value	Point prediction	*t* value	Point prediction	*t* value
1	0		0		0	
2	0.0009	0.60	-0.0010	-1.43	0.0032	1.65
3	0.0009	0.36	-0.0017	-1.28	0.0055	1.79
4	-0.0020	-0.58	-0.0021	-1.10	0.0079	1.97
5	-0.0062	-1.50	-0.0017	-0.68	0.0079	1.62
6	-0.0090	-1.89	-0.0018	-0.59	0.0063	1.11
7	-0.0124	-2.43	-0.0017	-0.50	0.0080	1.28
8	-0.0163	-2.99	-0.0007	-0.17	0.0085	1.26
9	-0.0189	-3.21	0.0004	0.09	0.0090	1.27
10	-0.0218	-3.46	0.0013	0.30	0.0101	1.38
11	-0.0229	-3.42	0.0024	0.52	0.0094	1.26
12	-0.0223	-3.18	0.0038	0.80	0.0102	1.39
13	-0.0217	-2.98	0.0055	1.13	0.0122	1.69
14	-0.0201	-2.67	0.0074	1.50	0.0136	1.93
15	-0.0178	-2.33	0.0091	1.82	0.0152	2.19
16	-0.0156	-2.02	0.0106	2.09	0.0166	2.40
17	-0.0129	-1.67	0.0121	2.32	0.0172	2.49
18	-0.0103	-1.34	0.0133	2.48	0.0181	2.59
19	-0.0081	-1.07	0.0142	-2.58	0.0187	2.64
20	-0.0064	-0.85	0.0148	2.60	0.0188	2.61
21	-0.0052	-0.71	0.0150	2.56	0.0187	2.55
22	-0.0046	-0.64	0.0149	2.46	0.0182	2.44
23	-0.0043	-0.61	0.0146	2.34	0.0175	2.31
24	-0.0046	-0.66	0.0139	2.19	0.0169	2.19
25	-0.0052	-0.76	0.0131	2.02	0.0162	2.08
26	-0.0061	-0.91	0.0121	1.85	0.0154	1.94
27	-0.0072	-1.09	0.0110	1.67	0.0147	1.81
28	-0.0084	-1.27	0.0099	1.49	0.0139	1.67
29	-0.0094	-1.44	0.0088	1.31	0.0131	1.54
30	-0.0105	-1.61	0.0076	1.14	0.0124	1.41

Notes: The (adjusted) sample period is 1967 Q3– 1996 Q4. In each period, the *t* value is calculated by dividing the point prediction by the standard error.

may reflect the different movements of the impulse response functions of each lending institution. That is, banks substantially reduce their components of loans *in the beginning*; on the other hand, NBFIs slightly reduce or increase their components of loans (except C&I loans) in the beginning, but they somewhat significantly reduce or increase them in the *middle and later periods*. To the extent that the moment of substantial loan movements is different between banks and NBFIs, the *t* value may reflect such different movements.

Figure 2.9 exhibits the responses of total loans and components of loans (i.e., C&I loans, mortgages, and consumer credit) to either a federal funds rate shock or a new measure shock—for banks and NBFIs, respectively. The comparisons of the new measure and the conventional measure reveal that the VAR results using new measure (the right columns) shows somewhat stronger impact on total loans and components of loans than those using the conventional measure (the left columns). Overall, the estimated impact of the new measure is somewhat larger, faster, and substantially more significant than the impact of the conventional measure. (For the significant levels of banks and NBFIs in response to the conventional funds shocks, see Table 2.9, 2.10, and 2.11).

For both banks and NBFIs, although the responses of mortgages display very similar patterns to either the new measure shocks or the conventional funds rates shocks, the responses of C&I loans show that the impact of new measure is *substantially* stronger, quicker, and more statistically significant than that of the conventional measure for both banks and NBFIs. (For the statistically significant levels, see Table 2.10 and 2.11). Consumer loans respond *somewhat* more sensitively to new measure

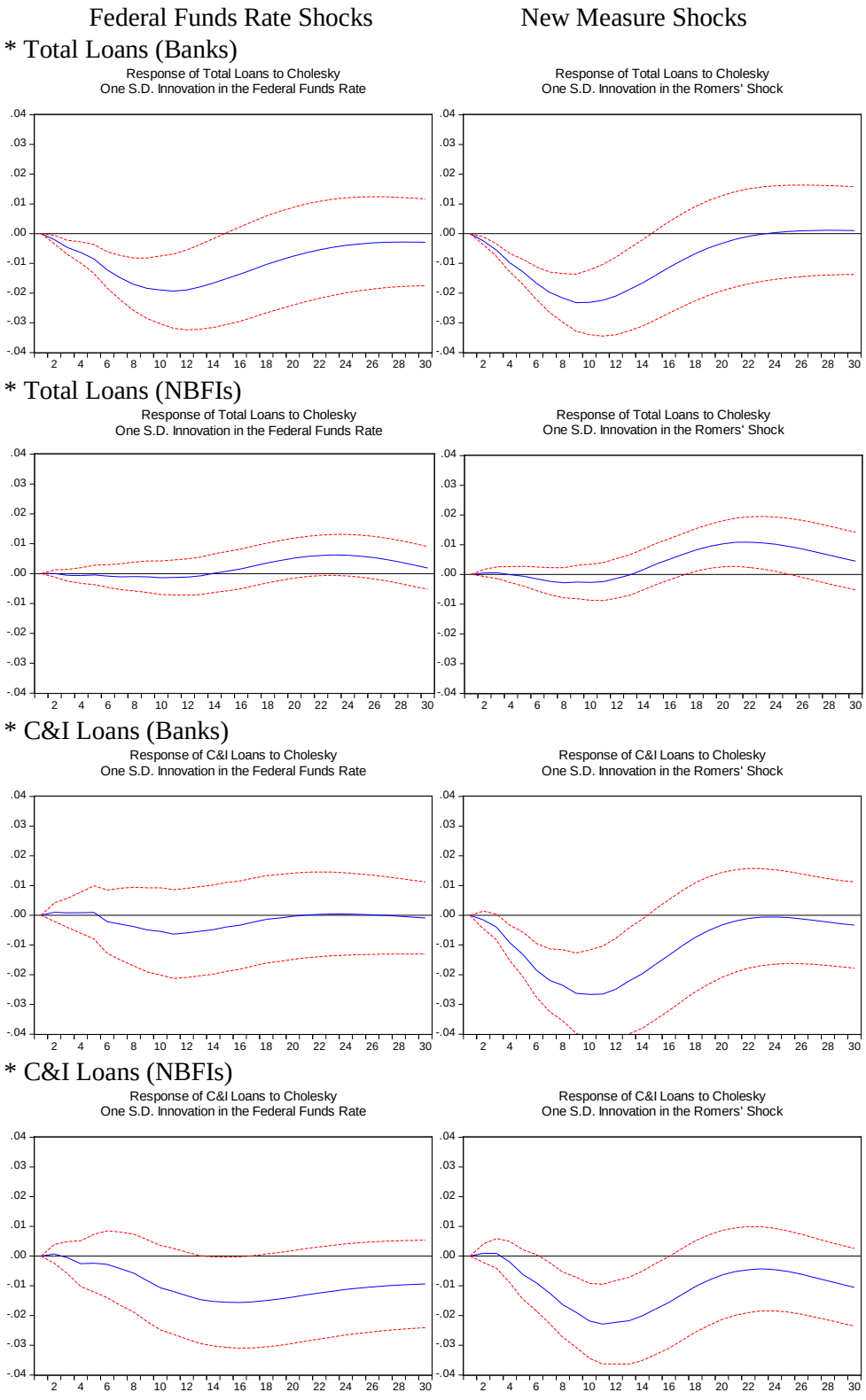
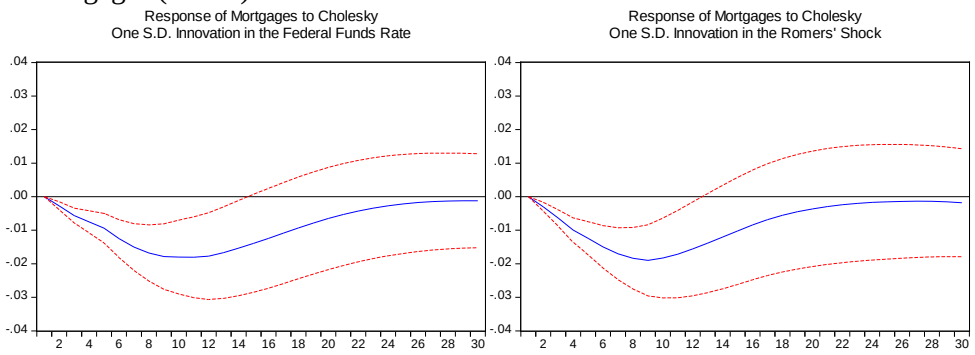


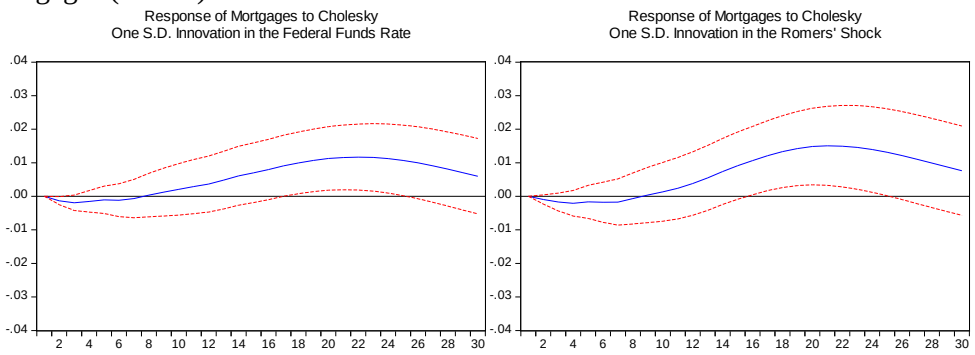
Figure 2.9 The Responses of Total Loans and Components of Loans to a Federal Funds Rate Shock and a New Measure Shock

Federal Funds Rate Shocks | New Measure Shocks

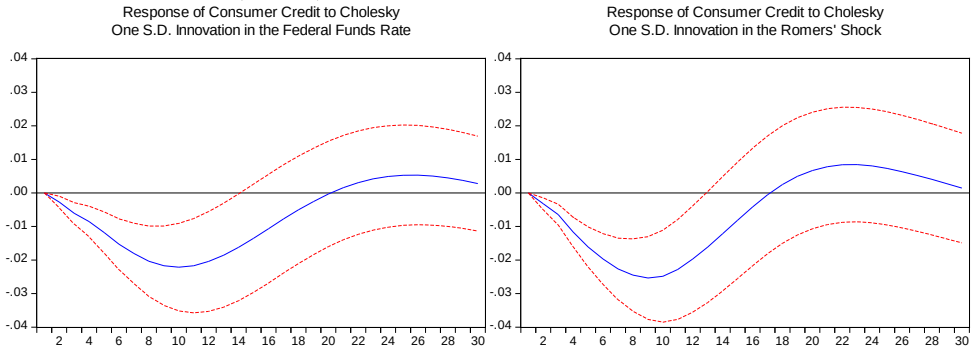
* Mortgages (Banks)



* Mortgages (NBFIs)



* Consumer Credit (Banks)



* Consumer Credit (NBFIs)

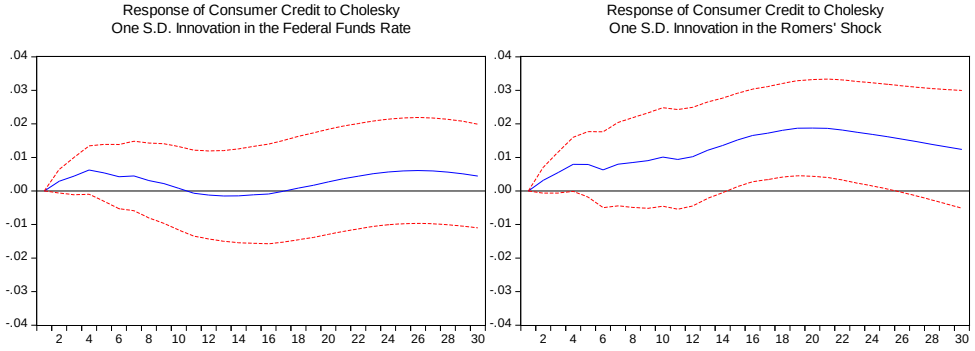


Figure 2.9 Continued

Federal Funds Rate Shocks

New Measure Shocks

* Monetary Policy Shocks

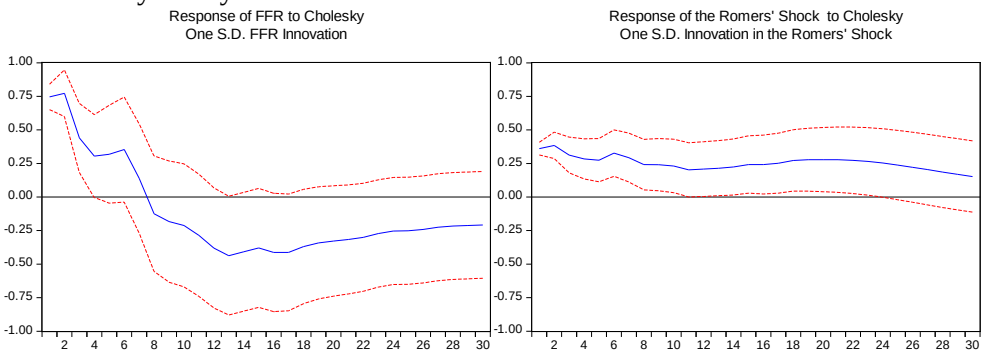


Figure 2.9 Continued

Table 2.9 The Impact of Conventional Funds Rate Shocks on Total Loans

Banks				NBFIs			
Period	Point prediction	Standard error	*t* value	Period	Point prediction	Standard error	*t* value
1	0	0		1	0	0	
2	-0.0020	0.0007	-2.84	2	0	0.0006	0.02
3	-0.0047	0.0012	-3.92	3	-0.0006	0.0010	-0.60
4	-0.0063	0.0018	-3.53	4	-0.0006	0.0013	-0.48
5	-0.0085	0.0024	-3.52	5	-0.0004	0.0016	-0.27
6	-0.0122	0.0031	-3.99	6	-0.0008	0.0019	-0.44
7	-0.0149	0.0037	-3.98	7	-0.0011	0.0022	-0.49
8	-0.0170	0.0044	-3.86	8	-0.0010	0.0024	-0.42
9	-0.0184	0.0051	-3.62	9	-0.0011	0.0026	-0.41
10	-0.0189	0.0057	-3.32	10	-0.0014	0.0028	-0.49
11	-0.0194	0.0063	-3.10	11	-0.0013	0.0029	-0.43
12	-0.0189	0.0067	-2.82	12	-0.0012	0.0031	-0.38
13	-0.0179	0.0071	-2.51	13	-0.0007	0.0032	-0.23
14	-0.0166	0.0075	-2.23	14	0.0002	0.0032	0.05
15	-0.0151	0.0077	-1.96	15	0.0008	0.0033	0.25
16	-0.0137	0.0079	-1.72	16	0.0016	0.0033	0.47
17	-0.0120	0.0081	-1.49	17	0.0026	0.0033	0.79
18	-0.0104	0.0082	-1.27	18	0.0036	0.0033	1.07
19	-0.0090	0.0082	-1.09	19	0.0044	0.0034	1.32
20	-0.0076	0.0082	-0.93	20	0.0052	0.0034	1.55
21	-0.0064	0.0082	-0.78	21	0.0058	0.0034	1.71
22	-0.0055	0.0082	-0.67	22	0.0061	0.0034	1.79
23	-0.0046	0.0081	-0.57	23	0.0062	0.0034	1.82
24	-0.0040	0.0080	-0.49	24	0.0061	0.0035	1.77
25	-0.0035	0.0079	-0.44	25	0.0058	0.0035	1.65
26	-0.0031	0.0078	-0.40	26	0.0053	0.0036	1.49
27	-0.0029	0.0076	-0.38	27	0.0046	0.0036	1.29
28	-0.0028	0.0075	-0.38	28	0.0038	0.0036	1.05
29	-0.0028	0.0074	-0.38	29	0.0029	0.0036	0.79
30	-0.0029	0.0073	-0.40	30	0.0019	0.0036	0.53

Notes: The (adjusted) sample period is 1967 Q3– 1996 Q4. In each period, the *t* value is calculated by dividing the point prediction by the standard error.

Table 2.10 The Impact of Conventional Funds Rate Shocks on Components of Loans (Banks)

Banks						
	C&I Loans		Mortgages		Consumer Credit	
Period	Prediction point	*t* value	Point prediction	*t* value	Point prediction	*t* value
1	0		0		0	
2	0.0010	0.66	-0.0027	-4.56	-0.0027	-3.13
3	0.0008	0.33	-0.0056	-5.07	-0.0061	-3.84
4	0.0009	0.25	-0.0075	-4.55	-0.0085	-3.74
5	0.0010	0.22	-0.0094	-4.24	-0.0118	-3.85
6	-0.0022	-0.41	-0.0125	-4.45	-0.0153	-4.05
7	-0.0030	-0.50	-0.0150	-4.32	-0.0180	-4.00
8	-0.0038	-0.58	-0.0168	-4.01	-0.0204	-3.89
9	-0.0049	-0.70	-0.0179	-3.65	-0.0217	-3.66
10	-0.0054	-0.74	-0.0180	-3.27	-0.0221	-3.39
11	-0.0063	-0.85	-0.0181	-3.00	-0.0217	-3.09
12	-0.0059	-0.79	-0.0177	-2.74	-0.0204	-2.74
13	-0.0054	-0.72	-0.0167	-2.44	-0.0186	-2.39
14	-0.0049	-0.65	-0.0153	-2.16	-0.0162	-2.04
15	-0.0039	-0.52	-0.0139	-1.91	-0.0135	-1.68
16	-0.0033	-0.45	-0.0124	-1.67	-0.0107	-1.32
17	-0.0023	-0.31	-0.0108	-1.44	-0.0077	-0.96
18	-0.0014	-0.19	-0.0093	-1.23	-0.0050	-0.63
19	-0.0009	-0.12	-0.0079	-1.03	-0.0026	-0.32
20	-0.0003	-0.05	-0.0065	-0.85	-0.0003	-0.04
21	0.0001	0.01	-0.0053	-0.70	0.0016	0.20
22	0.0003	0.04	-0.0043	-0.57	0.0031	0.40
23	0.0004	0.06	-0.0034	-0.46	0.0042	0.55
24	0.0004	0.06	-0.0027	-0.37	0.0049	0.65
25	0.0003	0.04	-0.0022	-0.29	0.0053	0.71
26	0.0002	0.02	-0.0017	-0.24	0.0053	0.72
27	0.0000	-0.01	-0.0015	-0.20	0.0050	0.69
28	-0.0003	-0.05	-0.0013	-0.18	0.0045	0.62
29	-0.0006	-0.10	-0.0012	-0.17	0.0037	0.52
30	-0.0009	-0.15	-0.0012	-0.17	0.0028	0.39

Notes: The (adjusted) sample period is 1967 Q3– 1996 Q4. In each period, the *t* value is calculated by dividing the point prediction by the standard error.

Table 2.11 The Impact of Conventional Funds Rate Shocks on Components of Loans (NBFIs)

NBFIs						
	C&I Loans		Mortgages		Consumer Credit	
Period	Prediction point	*t* value	Point prediction	*t* value	Point prediction	*t* value
1	0		0		0	
2	0.0007	0.46	-0.0013	-2.21	0.0029	1.65
3	-0.0006	-0.20	-0.0019	-1.68	0.0044	1.58
4	-0.0025	-0.66	-0.0015	-0.94	0.0062	1.73
5	-0.0024	-0.49	-0.0010	-0.51	0.0054	1.27
6	-0.0028	-0.50	-0.0012	-0.48	0.0043	0.89
7	-0.0043	-0.69	-0.0007	-0.24	0.0045	0.86
8	-0.0057	-0.87	0.0004	0.11	0.0031	0.56
9	-0.0083	-1.20	0.0013	0.35	0.0022	0.37
10	-0.0106	-1.50	0.0021	0.54	0.0008	0.12
11	-0.0119	-1.65	0.0029	0.72	-0.0007	-0.10
12	-0.0133	-1.83	0.0036	0.87	-0.0012	-0.18
13	-0.0146	-1.98	0.0048	1.12	-0.0015	-0.22
14	-0.0152	-2.04	0.0061	1.40	-0.0015	-0.21
15	-0.0155	-2.04	0.0070	1.58	-0.0012	-0.16
16	-0.0156	-2.03	0.0080	1.78	-0.0009	-0.12
17	-0.0154	-1.98	0.0091	2.00	-0.0001	-0.01
18	-0.0149	-1.92	0.0100	2.16	0.0009	0.11
19	-0.0144	-1.85	0.0107	2.29	0.0017	0.22
20	-0.0138	-1.77	0.0113	2.38	0.0027	0.35
21	-0.0130	-1.68	0.0116	2.40	0.0036	0.46
22	-0.0124	-1.60	0.0117	2.37	0.0044	0.56
23	-0.0118	-1.54	0.0116	2.31	0.0051	0.65
24	-0.0112	-1.46	0.0112	2.19	0.0057	0.72
25	-0.0108	-1.41	0.0107	2.03	0.0060	0.76
26	-0.0104	-1.37	0.0100	1.86	0.0061	0.77
27	-0.0100	-1.33	0.0091	1.67	0.0060	0.76
28	-0.0098	-1.31	0.0081	1.47	0.0056	0.72
29	-0.0096	-1.29	0.0071	1.26	0.0051	0.66
30	-0.0094	-1.27	0.0060	1.06	0.0044	0.58

Notes: The (adjusted) sample period is 1967 Q3– 1996 Q4. In each period, the *t* value is calculated by dividing the point prediction by the standard error.

than to the conventional measure. All of these results are consistent with results produced from Romer and Romer (2004), who examine the relationship between their new measure or conventional measure and the real economy. Remember that one obtains the new measure by filtering the endogenous movements of the funds rate and anticipatory movements of the Fed from the nominal funds rate. Therefore, "[this result] suggests that the endogenous behavior of the funds rate and the anticipatory component of Federal Reserve actions may be substantial in [C&I loans], and may obscure some of the true relationship between monetary policy and [the loan growth]" (Romer & Romer, 2004, p. 1056).

2.6.2 Bank Lending Standards

In addition to the employment of a new measure of monetary policy, I employ bank lending standards to examine the behavior of banks and NBFIs. [43] Lown and Morgan (2002, 2006) find that changes in lending standards are important in explaining variation in business loans and output; monetary policy (measured by the funds rate) decreases its impact on output when standards are taken into account; and monetary policy has little effect on lending standards.

Lown and Morgan rationalize that the strong impact of standards may reflect the policymakers' use of *moral suasion* to limit the volume of credit during periods of tight monetary policy. This is so because moral suasion was prevalent until the early 1980s. However, although policymakers do not employ such suasion in recent years, Lown and

[43] Lown and Morgan (2006) define standards as follows: "We use "standards" to refer to any of the various nonprice lending terms specified in the typical bank business loan or line of credit: collateral, covenants, loan limits, etc. One goal here is to show that the standards series in this paper makes a reasonable index for the full vector of nonprice lending terms. Our concept of standards is closely tied to the informational frictions that occupy so much of the modern literature on credit markets" (p. 1577).

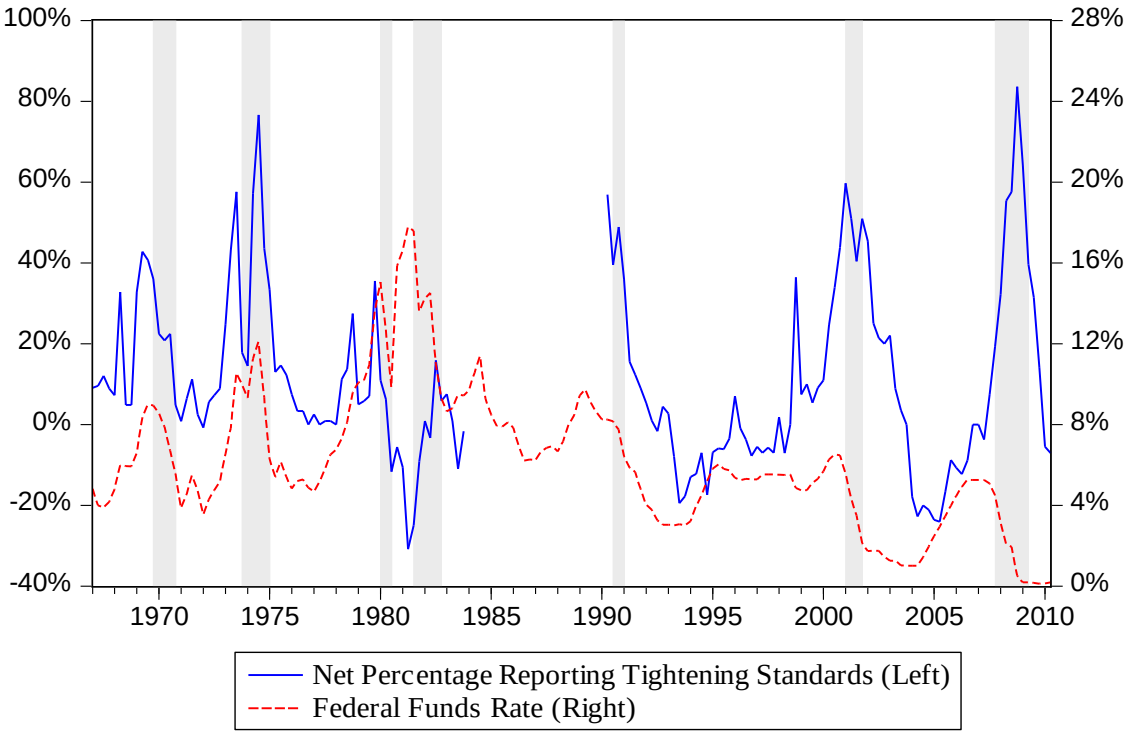
Morgan (2002) find that standards still have a powerful impact on loans and output during the post-1990 subsample. They suggest that bank lending standard may be a proxy for credit market imperfections; because of credit market imperfections, banks may tighten standards in response to exacerbation in their own or firms' balance sheets that may be caused by tight monetary policy.

If bank lending standards are a proxy for credit market imperfections—especially the availability of loans in credit markets—*NBFI* lending standards may be also a proxy for credit market imperfections. This is because NBFIs also deal with information problematic borrowers (especially small firms) who are subject to credit market imperfections. However, because the data of NBFI lending standards are not available, one can assume that NBFIs change their standards in a similar way as banks. Such an assumption is reasonable because both banks and NBFIs are likely to tighten their credit if an adverse shock hits the economy and thus worsens their own or firms' balance sheets. Under this assumption, I use the bank lending standards as a substitute for nonbank lending standards.

The Federal Reserve conducts a survey on the lending conditions of businesses over the past 3 months, pursuing qualitative information about changes in the bank lending practices in the U.S. credit markets. Loan officers at large U.S. banks in a sample has been asked the following question: "Over the past three months, how have your bank's credit standards for approving for loan application for—excluding those to finance mergers and acquisitions—C&I loans or credit lines changed?" Respondents (i.e., senior loan offices at banks) can answer the questions with one of the five given choices: (1) Tightened considerably, (2) tightened somewhat, (3) remained basically unchanged,

(4) eased somewhat, and (5) eased considerably.

Figure 2.10 exhibits lenders' responses to the question on standards—the net percent reporting tightening standards—and federal funds rate. Notice that, since the question was dropped from the survey between 1984 Q1 and 1990 Q1, these periods are excluded in the analysis. Since 1992 Q2, lenders have been asked to report standards for small firms and standards for larger firms separately. Following Lown and Morgan (2006), I use standards for *larger* firms as a proxy for standard for all firms because larger firms account for large portion of total loans. Nonetheless, the correlation between these two kinds of firms (0.95) shows that the choice is not so important. As shown in Figure 2.10, tighter standards appear to be positively correlated to tighter monetary policy. Although standards and monetary policy generally move in the same



Shaded areas indicate the NBER recessions

Figure 2.10 Changes in C&I Loan Standards and Federal Funds Rate

directions, there are two stark exceptions: 1980 to 1981 and 2007 to 2008.[44] In addition, notice that tighter lending standards and tighter monetary policy normally occur before recessions.

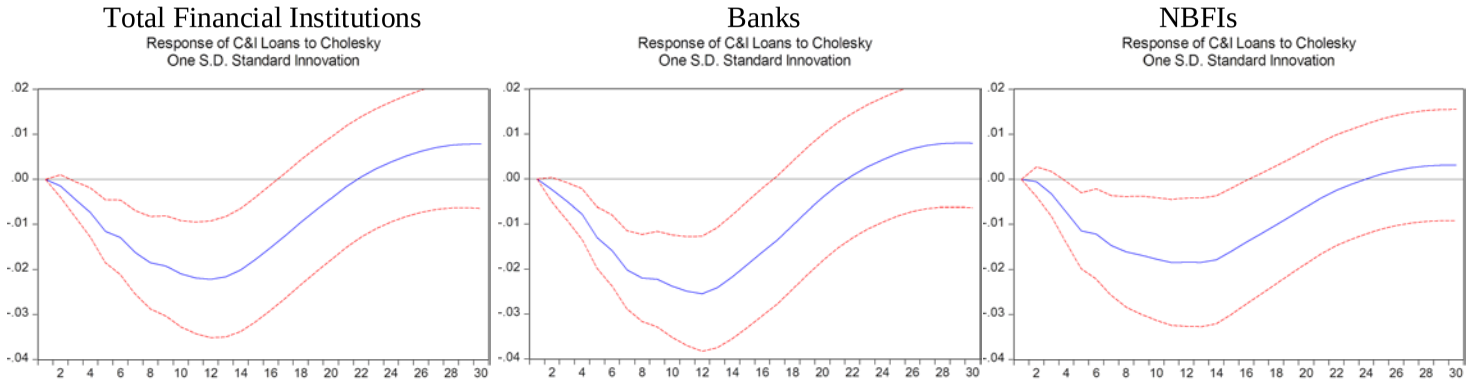
Following the analysis of Lown and Morgan (2006), I employ the VARs that comprise of the following six variables: the log of real GDP (Y), the log of Consumer Price Index (CPI), the log of Producer Price Index (PPI), Federal Funds Rate (FFR), the log of real C&I loans (CI), and net percentage standards (STND).[45] The VARs are made up of a potentially complete macro economy and credit markets, which are represented by the first four variables and last two variables, respectively. As in Section 1.5.2, six lags of each variable are used and all variables are seasonally adjusted. I estimate the VAR over the disjoint periods where the data on standards are available for the following periods: 1967 Q1 to 1983 Q4 and 1990 Q2 to 2010 Q2.

Figure 2.11 plots selected impulse response functions from the VAR where variables are ordered in the following way: Y_t, CPI_t, PPI_t, FFR_t, CI_t, and $STND_t$. The C&I loans of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—are entered into the VAR. After one-standard-deviation credit standard shock, banks and NBFIs show very similar responses of C&I loans, GDP, the federal funds rate, and their own standards. The standard shock, shown in the last row and all

[44] Over 1981 and 1982, while bankers report easing standards, the federal funds rate sharply rose. According to Lown and Morgan (2002), "[t]he consumer credit controls imposed between March and July 1980 may have prompted easier *commercial* standards to replace lost business on the consumer side" (p. 233). On the other hand, over 2007 and 2008, while bankers report tightening standard, the funds rate falls. This seems to me that since the early 2000s, changes in standards are followed by the federal funds rate after about a year, rather than coinciding with the funds rate.

[45] Rather Romer's new measure of monetary policy, the federal funds rate is used as an indicator of monetary policy because we lose a great deal of sample periods from the availability of Romer's measure (1967 Q3–1996 Q4) and the availability of standards (1967 Q1–1983 Q4 and 1990 Q2–2010 Q2).

* C&I Loans



* GDP

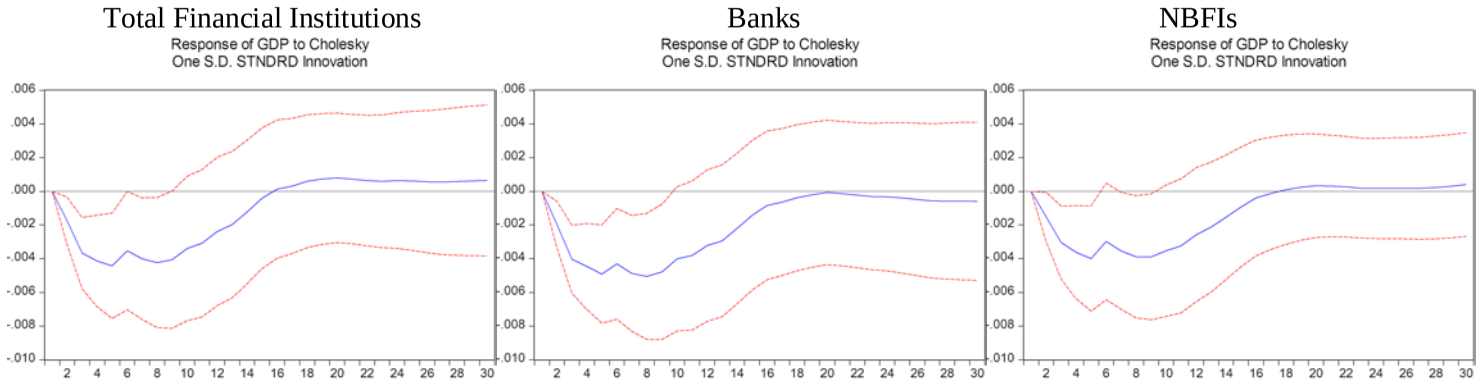


Figure 2.11 Responses of C&I Loans, GDP, Federal Funds Rate, Standards to One S.D. Standard Shock

VAR Ordering: Y, CPI, PPI, FFR, CI, STND

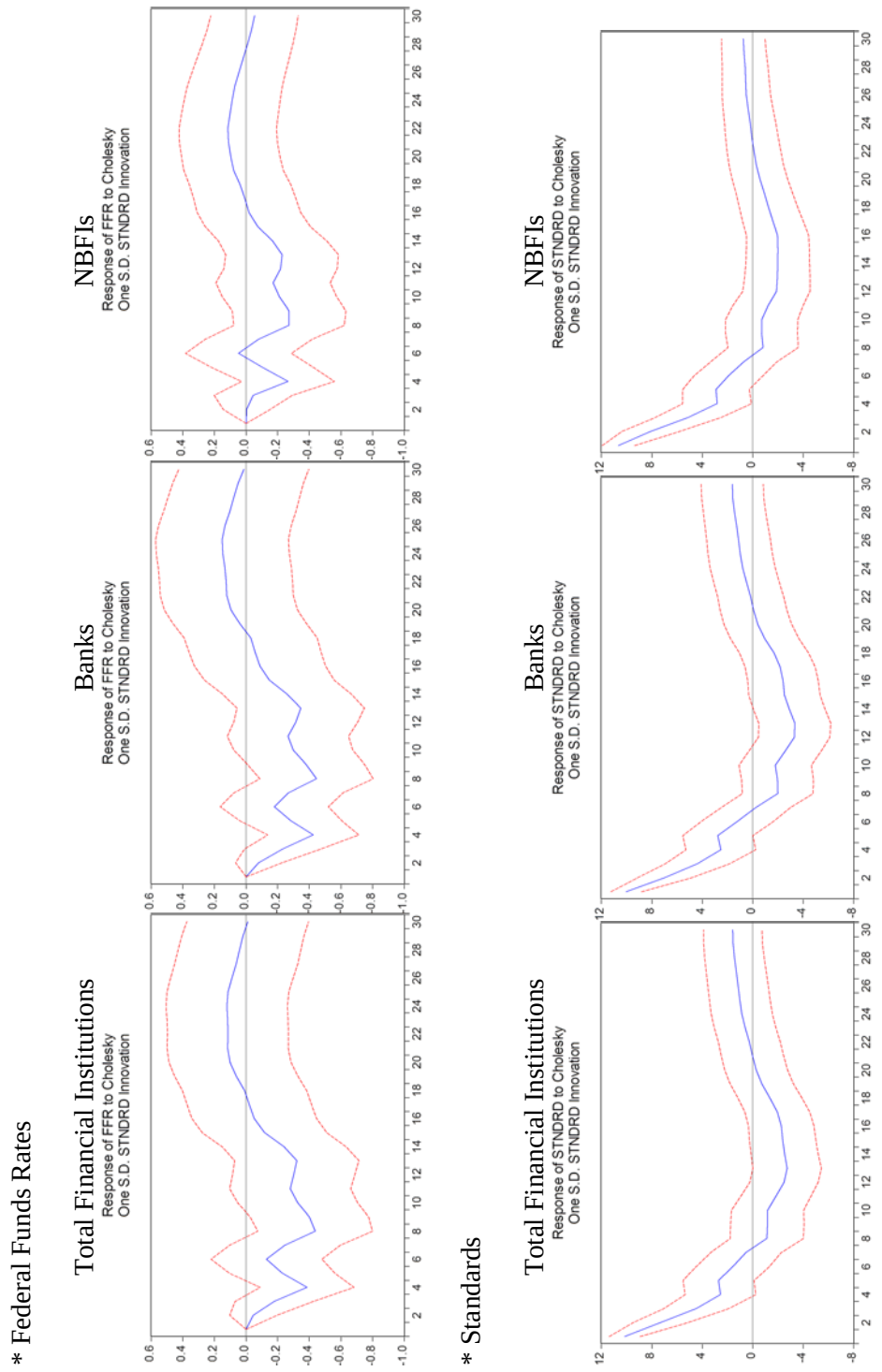


Figure 2.11 Continued

three columns, initially appears as a sharp, significant rise of approximately 10% on net. Remember that standards are measured by *changes* in percentage and other variables are measured by the level. Tightening standards accumulates for 6 quarters. Then, from about 7 to 21 quarters, lenders continue to ease standards in order to cancel out the cumulative tight standards occurred in quarters 1 through 6.

The responses of C&I loans and GDP, and the federal funds rate are striking. All of these variables decline immediately and substantially in response to the standard shock—for both banks and NBFIs. C&I loans decline around −2.2% at its trough for total financial institutions: −2.6% for banks and −1.8% for NBIFs. GDP falls around −0.44% at its trough for total financial institutions: −0.51% for banks and −0.4% for NBFIs. These figures indicate that, after a standard shock, C&I loans decrease much more than GDP. Similarly, after tightening in standards, the federal funds rate immediately falls about a year and then drops a little more with a seesaw motion about another year; the lowest points are −0.44, −0.45, and −0.27% for total financial institutions, banks, and NBFIs, respectively. The reduction of the federal funds rate suggests that the Fed tries to mitigate the tight credit conditions (or tight standards) by decreasing the federal funds rate. Lown and Morgan (2006) describe such behavior of the Fed in the subsequent way: “monetary policymakers follow a “lean-against-lenders” strategy” (p. 1596). In addition, overall, standards have stronger impact on banks than on NBFIs for all of the variables (i.e., C&I loans, GDP, and the federal funds rate).

As mentioned earlier, under the assumption that NBFIs can change their standards in a similar manner to banks, I have employed bank lending standards as a proxy for NBFI lending standards. Under this assumption, I find that, in response to a standard

shock, the C&I loans, GDP, and federal funds rate of NBFIs move very similarly to those of banks. Such evidence suggests that, if NBFIs shift their lending standards in a similar manner to banks, and if NBFIs reduce their C&I loans just like banks, tight lending standards made by NBFIs are likely to decrease output—just as tight standards made by banks decrease output.

2.7 Conclusion

Despite a substantially growing importance of NBFIs in the financial system, the role of NBFIs in the monetary transmission mechanism has received much less attention. This research paper addresses this issue by examining how a monetary policy shock influences both banks and NBFIs in the monetary transmission mechanism, both theoretically and empirically.

Theoretically, I provide an explanation of how monetary policy affects the financial condition of banks and NBFIs and then the supply of loans to intermediary-dependent borrowers. Tight monetary policy deteriorates the financial conditions of all intermediaries through the fall of their net worth (i.e., the bank capital channel). When all intermediaries, in turn, must turn to uninsured nondeposit funds, they will face the higher cost of funds because uninsured nondeposit funds reflect the credit risks, or a lemon premium, associated with the uninsured lending (i.e., the adverse selection model). Ultimately, intermediaries, which undergo a higher cost of external finance, respond by reducing the supply of loans to their borrowers. This explanation suggests that monetary policy may exert significant influence on the supply of *intermediated loans* through the medium of *net worth* of all participating financial intermediaries.

Empirically, I provide some evidence for this explanation, employing two different methods: the traditional OLS methodology and the VAR methodology. The evidence is largely consistent with the study's theoretical predictions and suggests that NBFIs respond to a monetary policy shock in the same way as banks do; a tight monetary policy leads not only to a reduction in their *net worth*, but also to a shrinkage in the *intermediated loans* of all financial participants. Specifically, this empirical study strongly supports the first part of the theory, which is that NBFIs reduce their net worth after tightening monetary policy, presenting consistent results with two different methodologies – particularly the statistically significant results with 2% for the OLS model. On the other hand, it weakly supports the second part of the theory, which is that NBFIs decrease their loans in response to a monetary policy shock. That is, although NBFIs respond to reduce their loans in the either methodology—reporting the results by the negative signs of the coefficient of loans in the OLS and by negative reaction of impulse response function in the VAR—the results of the OLS are not statistically significant. In particular, this study has also investigated not only the response of aggregate loans, but also the response of components of loans, after a monetary tightening. The results show that real estate loans and consumer loans significantly *decrease*, as the theory would predict, whereas C&I loans *increase*. These results are consistent with the results produced by the previous researchers.

A number of economists maintain that some NBFIs, particularly investment banks, played a major role in causing the Great Recession of the 2007, while highlighting their significant growth in the financial system. Subsequent to financial crisis in 2008, the activities of NBFIs came under increasing scrutiny and regulations and NBFIs are

required to meet tougher standard than before. Although such strict oversight may help to regulate the risky behavior of NBFIs, it has nothing to do with the monetary policy that we have discussed here. According to the theoretical explanation offered and some evidence presented here, I suggest that monetary policy may be able to influence the behavior of both banks and NBFIs. If so, monetary policy may have an additional impact on the loans provided by NBFIs in the monetary transmission mechanism. In particular, this study suggests a clue for the puzzle of the existing empirical findings. In the traditional view, “interest sensitive” components of aggregate spending encountered great difficulty in identifying quantitatively significant effect of traditional interest rate channel. By including these NBFIs within the boundaries of monetary policy, policymakers may be able to better understand the monetary transmission mechanism and, thereby, can more accurately assess the timing and effects of monetary policy on the economy.

2.8 Appendices

2.8.1 Appendix A: Determination in the Number of Lags (VAR)

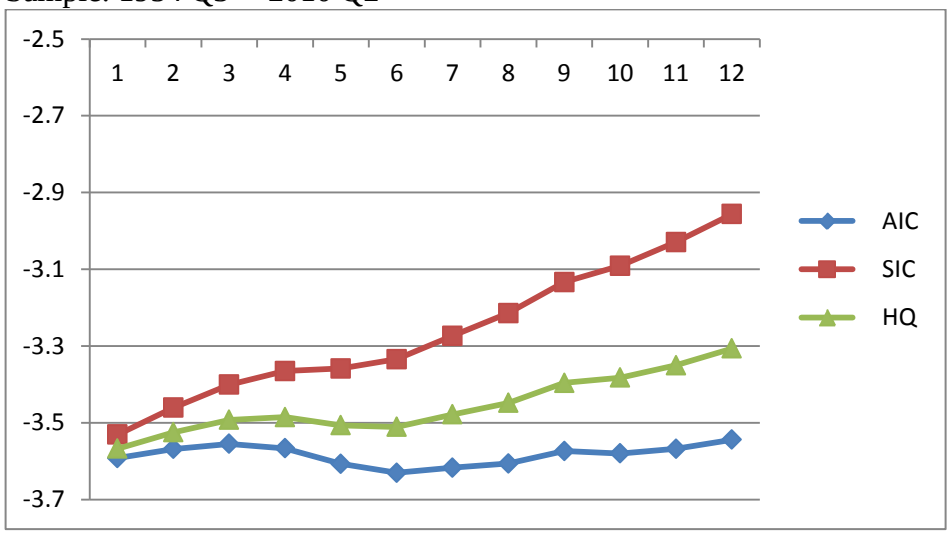
VAR Lag Order Selection Criteria
Endogenous variables: LNRGDP LNCPI LNRIM_SA FFR
Exogenous variables: C
Date: 04/14/11 Time: 17:08
Sample: 1954Q3 2010Q2
Included observations: 212

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-312.6660	NA	0.000233	2.987415	3.050747	3.013012
1	1957.030	4432.330	1.36e-13	-18.27386	-17.95720	-18.14588
2	2127.217	325.9259	3.18e-14	-19.72847	-19.15848*	-19.49809
3	2169.831	80.00009	2.47e-14	-19.97953	-19.15622	-19.64677*
4	2187.306	32.14743	2.44e-14	-19.99345	-18.91681	-19.55830
5	2198.508	20.18529	2.56e-14	-19.94819	-18.61822	-19.41065
6	2230.411	56.28188	2.21e-14*	-20.09822*	-18.51492	-19.45829
7	2240.968	18.22662	2.33e-14	-20.04687	-18.21025	-19.30455
8	2251.937	18.52168	2.45e-14	-19.99940	-17.90945	-19.15469
9	2268.180	26.81755	2.45e-14	-20.00170	-17.65842	-19.05460
10	2280.168	19.33886	2.56e-14	-19.96385	-17.36725	-18.91436
11	2303.958	37.48073*	2.40e-14	-20.03734	-17.18741	-18.88547
12	2314.667	16.46639	2.54e-14	-19.98742	-16.88416	-18.73316

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

2.8.2 Appendix B: Determination in the Number of Lags for Net Worth (OLS)[46]

Sample: 1954 Q3 ─ 2010 Q2



Notes: AIC (Akaike information criterion), SIC (Schwarz information criterion), HQ (Hannan-Quinn information criterion)

2.8.3 Appendix C: Responses of Net Worth (8 Lags)

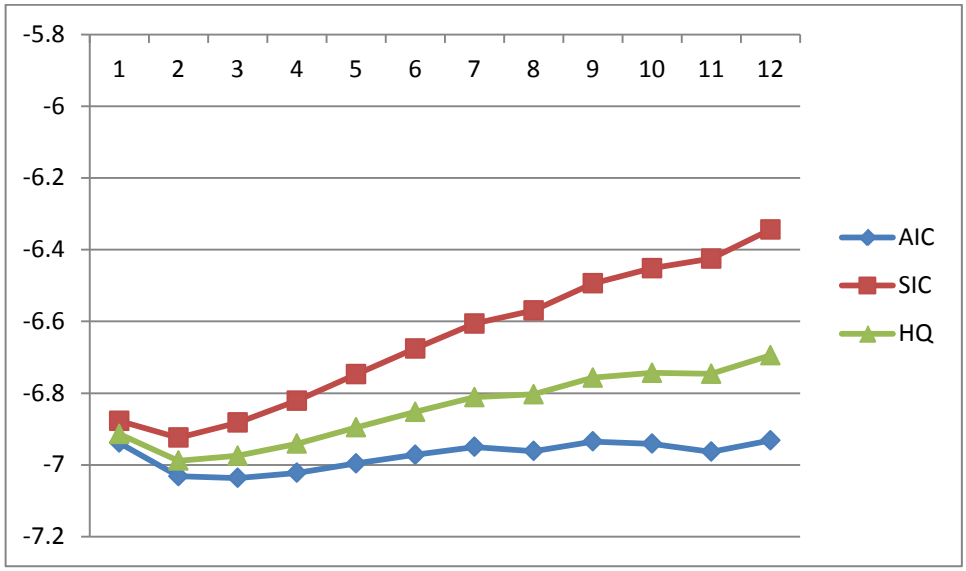
	Total Financial Institutions		Banks		NBIFs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Net Worth (bivariate)	−0.033*** (4.03)	0.0012***	−0.042*** (2.74)	0.0136***	−0.031*** (2.75)	0.026**
Net Worth (multivariate)	−0.042*** (4.48)	0.0001***	−0.048*** (2.72)	0.0253**	−0.041*** (3.26)	0.0032***

Notes: In the bivariate model, the net worth of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—is regressed against a constant, 8 lags of itself, and 8 lags of a monetary policy indicator (MP). In the multivariate model, 8 lags of GDP are added to the regression. All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5 %, and 1%, respectively.

[46] AIC have chosen lag 6 as an optimum number of lag, whereas SIC and HQ have determined lag 1 as an optimum. However, as you see the graph above, HQ shows a strong tendency to decline at lag 6 as well. Therefore, the results of lag 6 in net worth are reported as a benchmark. In addition, to make a comparison with the number of lags in loans, the results of lag 8 are also reported in Appendix C.

2.8.4 Appendix D: Determination in the Number of Lags for Loans (OLS)

Sample: 1954Q3 2010Q2



Notes: AIC (Akaike information criterion), SIC (Schwarz information criterion), HQ (Hannan-Quinn information criterion)

2.8.5 Appendix E: Responses of Loans (2 Lags and 6 Lags)

A. Responses of Loans (2 Lags)

Bivariate Model

	Total Financial Institutions		Banks		NBFIs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Total Loans	−0.0020***	0.0094***	−0.0022***	0.0585*	−0.0003	0.7914
	(2.74)		(2.26)		(0.26)	
C & I Loans	0.0005	0.9511	0.0007	0.8641	0.0028	0.2239
	(0.32)		(0.39)		(1.42)	
Mortgages	−0.0023***	0.0001***	−0.0029***	0.0026***	−0.0006	0.0055***
	(3.87)		(3.43)		(0.84)	
Consumer Loans	−0.0017*	0.1332	−0.0036*	0.2142	0.0028	0.4452
	(1.79)		(1.75)		(0.94)	

Notes: In the bivariate model, aggregate loans (or components of loans) of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—are regressed against a constant, 8 lags of itself, and 8 lags of a monetary policy indicator (MP). All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Multivariate Model

	Total Financial Institutions		Banks		NBFIs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Total Loans	−0.0033***	0.0000***	−0.0038***	0.0000***	−0.0017**	0.0791*
	(4.45)		(3.78)		(2.05)	
C & I Loans	−0.0020	0.4214	−0.0022	0.3790	–0.0001	0.8695
	(1.25)		(1.18)		(0.06)	
Mortgages	−0.0033***	0.0000***	−0.0040***	0.0001***	−0.0014*	0.0019***
	(4.45)		(4.43)		(1.75)	
Consumer Loans	−0.0038***	0.0004***	−0.0064***	0.0094***	−0.0004	0.8025
	(3.84)		(3.01)		(0.13)	

Notes: In the multivariate model, aggregate loans (or components of loans) of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—are regressed against a constant, 8 lags of itself, 8 lags of a monetary policy indicator (MP), and 8 lags of GDP. All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

B. Responses of Loans (6 Lags)

Bivariate Model

	Total Financial Institutions		Banks		NBFIs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Total Loans	−0.0039***	0.0235**	−0.0058***	0.0043***	−0.0011	0.8782
	(3.21)		(3.57)		(0.87)	
C & I Loans	0.0018	0.5356	0.0029	0.1527	−0.0004	0.4705
	(0.66)		(0.96)		(0.10)	
Mortgages	−0.0044***	0.0003***	−0.0077***	0.0001***	−0.0011	0.2755
	(4.21)		(5.16)		(0.94)	
Consumer Loans	−0.0047**	0.0453**	−0.0119***	0.0051**	−0.0024	0.7092
	(3.04)		(3.63)		(0.48)	

Notes: In the bivariate model, aggregate loans (or components of loans) of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—are regressed against a constant, 8 lags of itself, and 8 lags of a monetary policy indicator (MP). All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

Multivariate Model

	Total Financial Institutions		Banks		NBFIs	
	β_i sum	Exclusion	β_i sum	Exclusion	β_i sum	Exclusion
Total Loans	−0.0040***	0.0031***	−0.0053***	0.0049***	−0.0026**	0.4015
	(3.07)		(3.11)		(1.78)	
C & I Loans	0.0034	0.0459**	0.0038	0.0267**	0.0005	0.883
	(1.23)		(1.25)		(0.10)	
Mortgages	−0.0048***	0.0005***	−0.0076***	0.0003***	−0.0029**	0.1131
	(3.94)		(4.55)		(2.03)	
Consumer Loans	−0.0054***	0.0074***	−0.0075**	0.1068	−0.0051	0.7443
	(3.02)		(2.01)		(0.87)	

Notes: In the multivariate model, aggregate loans (or components of loans) of financial intermediaries—total financial institutions, banks, and NBFIs, respectively—are regressed against a constant, 8 lags of itself, 8 lags of a monetary policy indicator (MP), and 8 lags of GDP. All variables except MP take the logged form, and all variables including MP were differenced to the stationary form. Entries in the "β_i sum" columns show the sum of coefficients on the lags of monetary policy indicator with the *t* statistics in parentheses. Entries in "exclusion" columns show the marginal significant level for the test that MP does not help forecast the net worth. *, **, and *** denote significance at 10%, 5%, and 1%, respectively.

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CHAPTER 3

THE BEHAVIOR OF SMALL AND LARGE FIRMS DURING BUSINESS CYCLE EPISODES AND DURING MONETARY POLICY EPISODES: A COMPARISON OF EARLIER AND RECENT PERIODS

3.1 Introduction

When it comes to the topic of the business cycle, economists puzzle over how a small adverse shock—either a real shock or a monetary shock—can produce large fluctuations in an economy. One of the explanations proposed by a number of economists is a "financial accelerator" mechanism. An adverse shock to the economy may be enhanced by worsening credit-market conditions while it produces *interactions* between credit-market conditions (i.e., financial factors) and real economic activities (i.e., real factors). Continuous changes in credit market conditions play a critical role in business cycle fluctuations by amplifying and propagating the effect of the initial shock (Bernanke & Gertler, 1989; Bernanke, Gertler, & Gilchrist, 1996; Gertler & Gilchrist, 1993, 1994). In a standard macroeconomic theory, such changes in credit-market conditions play no role in business cycle fluctuations because the standard theory simply assumes perfect capital markets, separating financial factors from real factors. However, according to the financial accelerator mechanism, changes in credit-market conditions are essential to the propagation of business cycle because financial factors, which continuously interact with real factors, act as a catalyst in amplifying the effect of

the initial shock.

In previous research, economists found some evidence of this mechanism, putting a special emphasis on *small firms* (see Bernanke & Gertler, 1989; Bernanke et al., 1996; Gertler & Gilchrist, 1993, 1994). An adverse monetary shock is found to have a stronger negative impact on small firms than on large firms because small firms are more credit-constrained than large firms after a restrictive monetary shock. For example, following an adverse monetary shock, small firms, which undergo more severe exacerbation of balance sheet conditions, are likely to encounter higher costs of external finances than large firms in credit markets. Moreover, since small firms may not be able to obtain credit elsewhere—because they do not have access to public markets—if they are discriminated against by banks when seeking credit, they should cut back on their short-term debt more than large firms. Accordingly, small firms should also curtail their business operations more quickly and significantly than large firms in the economy.

Specifically, employing Quarterly Finance Report (QFR) data and "Romer dates" as an indicator of tight monetary policy, Gertler and Gilchrist (1994) examine the behavior of small and large firms after tight monetary policy. They find that tight monetary policy *differently* affects the behavior of small and large firms; the "inventories" and "short-term debt" of small firms drop substantially more than those of large firms. In particular, after a monetary policy shock, although large firms initially increase inventories and short-term debt much more than small firms, after a brief period, small firms decrease sharply more than large firms. They interpret this result as the supporting idea that large firms, which experience *easier* access to credit, may be able to finance

inventories with short-term debt after tightening monetary policy; thus, large firms initially increase short-term debt more than small firms. In contrast, small firms, which experience *difficulty* accessing credit, are unable to borrow to carry inventories. Likewise, employing the Dun & Bradstreet Corporation data, Birch (1979) finds that small establishments with 100 or fewer employees accounted for 81.5% of all new jobs created in the U.S. during 1960-1976; large establishments with 100 or more employees accounted for only 18.5% of all new jobs created (Birch, 1979, Table 4-2). Employing the Business Employment Dynamic (BED) data, Sahin, Kitao, Cororaton, and Laiu (2011) find that small firms shed more jobs than large firms during the 2007-2009 downturn.

Recently, however, new research findings raise questions about the role of small and large firms during periods of tight credit conditions.[1] New evidence has shown that an adverse macroeconomic shock (i.e., a business cycle shock) is found to have more serious negative effects on *large firms* than on small firms during period of recession. Large firms curtail their business operations such as employment, short-term debt, sales, and inventories substantially more than small firms (see Chari, Christiano, & Kehoe, 2007; Kudlyak, Price, & Sánchez, 2010; Moscarini & Postel-Vinay, 2008, 2009, 2012). Particularly, Chari et al. (2007) investigate the behavior of small and large firms after a business cycle shock, rather than a monetary policy shock that previous research focused on.[2] Their research is somewhat different from previous studies because other

[1] Such tight credit conditions can originate from a monetary policy shock or from other shocks that make credit more expensive and less available.

[2] In earlier work, Gertler and Gilchrist (1994) examine the behavior of small and large firms after a tight monetary shock (i.e., a Romer date), focusing recessions caused by a macroeconomic monetary policy shock. Recently, researchers have investigated the behavior of small and large firms after an

macroeconomic shocks, not including monetary shocks, also perform an essential role in causing recessions—that is, recessions are created by not only monetary policy shocks but also "other shocks" in the economy.[3] Recent research, therefore, has focused on business cycle episodes rather than monetary policy episodes in examining the behavior of small and large firms.

In particular, Chari et al. (2007) employ the same QFR data set as Gertler and Gilchrist (1994) and incorporate more business cycle episodes into their analysis. After including more episodes, they find that the sales of small and large firms respond roughly the *same* to a business cycle shock, a *different* result from Gertler and Gilchrist (1994). Furthermore, some other recent studies observe the *opposite* of past results. Using both Census Bureau's Business Dynamic Statistics (BDS) and the BED data, Moscarini and Postel-Vinay (2008, 2009, 2012) find that the employment of large firms is more sensitive to the business cycle conditions than that of small firms. Along the same lines, employing the same QFR data set and methodology as Gertler and Gilchrist (1994), Kudlyak et al. (2010) find that the sales and inventories of large firms decreased more than those of small firms during the recent 2007-2009 recession.

Synthesizing empirical evidence presented so far, scholars have found different empirical results, depending on their data sets and methodologies. Such mixed results have motivated me to examine further the behavior of small and large firms. Three natural questions arise from these mixed results: Why do earlier findings show different

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adverse shock (i.e., the date for peak of the business cycle), concentrating recessions brought about by a shock other than a monetary policy shock.

[3] For example, "other shocks" may occur when the price of commodities or natural resources increases sharply, when cataclysmic natural disasters or wars occur, and when dot-com or housing bubbles burst.

results from recent findings? Do such different results arise from the fact that different scholars use *different episodes*, tight policy episodes versus business cycles episodes, in their analysis? Do such different results arise from the fact that different scholars use *different time periods*, earlier periods versus recent periods, in their datasets?

In my research, the empirical tests to examine the behavior of small and large firms are performed in two ways: (1) by different episodes, monetary policy episodes and business cycles episodes, and (2) by different time periods, earlier periods and recent periods. First, I examine the behavior of small and large firms by comparing "monetary policy episodes" to "business cycle episodes." In this analysis, we presume that "monetary policy episodes" arise from *monetary policy* shocks, which are produced by the Federal Reserve to fight against inflation. On the other hand, "business cycle episodes" originate from shocks that *occur outside of monetary policy* and that *are naturally produced* in the economy. For our purposes, we call these other shocks "NBER recession shocks." Although previous studies employ "Romer dates" as a measure of monetary policy shocks, this research paper uses "Adrian dates" as a measure of those shocks because "Romer dates" have not been updated since 1988. As will be explained in Section 2, Adrian and Estrella (2008) identify the "*end* dates for monetary tightening cycle" as a measure of a (tight) monetary policy shock.[4] Additionally, this research paper uses the "dates for peaks of business cycles" as an indicator of business cycle shocks, following Chari et al. (2007) and Kudlyak et al. (2010).

[4] Although this study employs "Adrian dates" rather than "Romer dates" in the analysis, it finds that the results of "Adrian dates" are not materially different from those of "Romer dates" in earlier-period episodes.

Second, I examine the behavior of small and large firms by comparing "earlier periods" to "recent periods." The data of earlier periods extend from 1960 Q1 to 1989 Q4, [5] and the data of recent periods range from 1990 Q1 to 2011 Q2. To make use of all available data to date, this research paper has employed four different data sources: (1) the Flow of Funds, (2) the Quarterly Finance Report, (3) the Senior Loan Officer Opinion Survey, and (4) the Business Employment Dynamics. In particular, among these four data sets, only the flow of funds data are available for both earlier periods and recent periods, whereas the other three data sets are on hand only in recent periods.[6] Because of the limited availability of the other three data sets, a comparison between earlier periods and recent periods is made by the flow of fund data.[7]

By analyzing different "episodes" and different "time periods," this research paper adds some more evidence to the existing literature about the role of small and large firms. During *earlier* periods, similar to what the earlier researchers found, I find that, after a monetary policy shock, small firms decrease their inventories, total short-term debt, and bank debt more than large firms, using the flow of funds data. During *recent* periods, on the other hand, I find some interesting results that support recent research by using the flow of funds and the QFR data. First, the behavior of large firms is, in general, more sensitive than that of small firms—to either a monetary policy shock or

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[5] I divide earlier periods and recent periods by 1990 because previous researchers conducted their studies before 1990 and recent scholars have done them after 1990.

[6] For the QFR data, although the data of earlier periods are available by purchasing them from the private institutions, the data of recent periods are available to the public without any cost. Thus, recent periods of the QFR data are used in this analysis.

[7] Furthermore, it is worthwhile to carefully examine the flow of funds data and the SLOOS data in our study since previous research does not take into account these data. Although the QFR and the BED data are used in previous research, more recent data are incorporated in this analysis.

an NBER recession shock. In particular, after an NBER recession shock, large firms *sharply decrease* most of their balance sheet variables—sales, total short-term debt, short-term bank debt, mortgages, other debt, and trade debt—more than small firms. However, after a restrictive monetary shock, although large firms *decrease* some of their balance sheet variables—sales, inventories, mortgages, and trade debt—more than small firms, they *increase* their short-term debt, such as total short-term debt and short-term bank debt, more than small firms. Second, it appears that a monetary policy shock influences the short-term debt of firms *differently* than an NBER recession shock does. All firms *increase* their short-term debt after a restrictive monetary shock, whereas they *decrease* after an NBER recession shock. Furthermore, large firms increase short-term debt more than small firms after a monetary policy shock, and they also decrease more than small firms after an NBER recession shock.

For these empirical results, some questions arise. Why does the short-term debt of firms *increase* after a tight monetary shock but *decrease* after an NBER recession shock? Why is the short-term debt of large firms more sensitive to both a monetary shock and an NBER recession shock than that of small firms? Some plausible explanations to these questions are also suggested in this paper.

The remainder of this paper is organized as follows: Section 2 describes four different data sources and the key dates of analysis employed in this study; Section 3 applies the method of previous researchers to the recent data set of the QFR. Section 4 reports the empirical results of the study; Section 5 discusses two explanations as to why the short-term debt of large firms shows more sensitive behavior than that of small firms after an adverse shock; Section 6 summarizes and concludes the work.

3.2 Data Description and Some Key Dates of Analysis

3.2.1 Data Description

3.2.1.1 The Flow of Funds Data

The Federal Reserve has released the quarterly data of the *flow of funds accounts of the United State*s since 1952. The flow of funds accounts are a set of financial accounts used to measure sources and uses of funds for the economy as a whole and by sector. They contain the aggregate balance sheets of each sector of the economy—i.e., a household sector, a nonfinancial business sector, a financial business sector, a government sector, and the rest of the world. "The nonfinancial business sector" comprises three subsectors: nonfarm nonfinancial corporate business, nonfarm noncorporate business, and farm business.

In this nonfinancial business sector, "nonfarm nonfinancial corporate business" can be thought of as large firms because it involves all large private businesses that exclude farm business and financial institutions, S-corporations, and so on. On the other hand, "nonfarm noncorporate business" can be thought of as small firms because it includes somewhat small firms such as partnerships, limited liability companies, and sole proprietorships—which do not have access to capital markets and thus mainly make use of intermediated loans. Nonetheless, some of the partnerships included in "nonfarm noncorporate business" (i.e., small firms) are in fact large corporations. This is because the distinction between "nonfarm nonfinancial corporation business" and "nonfarm noncorporate business" is made simply on the basis of tax-paying method rather than according to the firm sizes. For this reason, small firms in the flow of funds data (i.e., nonfarm noncorporate business) are considered somewhat larger than small firms in the

QFR data (i.e., below the 30th percentile in sales distribution) as described below.

3.2.1.2 The Quarterly Finance Report Data

The U.S. Census Bureau has released the quarterly data on the *Quarterly Finance Report for Manufacturing, Mining, Trade, and Selected Service Industries* (QFR) since 1982. Prior to 1982, the QFR was published by the Federal Trade Commission (FTC) and Security and Exchange Commission (SEC). Based on a sample survey, the QFR publication presents the statistical data on a quarterly balance sheet and income statement for manufacturing, mining, trade, and selected service industries. [8, 9]

Specifically, the QFR includes estimated statements of income, retained earnings, balance sheets, and related financial and operating ratios for manufacturing corporations with the assets of $250,000 and over. The data of manufacturing corporations are classified by eight asset sizes. The reported size classes are made up of corporations: those with assets of (1) less than $5 million, (2) $5 to $10 million, (3) $10 to $25 million, (4) $25 to 50 million, (5) $50 to $100 million, (6) $100 to $250 million, (7) $250 million to $1 billion, and (8) more than $1 billion. The merit of the QFR data is that they include relatively small firms compared to the Compustat data. While Compustat data cover the relatively large firms whose equities are traded in the public market, the QFR data covers both the publicly traded large firms and the privately held small firms.

[8] While historical data from before 1987 Q4 are available from the private institutions by purchase, the data of recent periods are available to us without any cost at the U.S. Census Bureau' internet Website. http://www.census.gov/econ/qfr/historic.html In this study, because of limited availability of the QFR data, I have only used the data set, which covers the periods from 1987 Q4 to 2011 Q3.

[9] The data of manufacturing industry contains information about firm sizes, while the data of mining, trade, and selected service industries do not include such information. Thus, only the data of the manufacturing industry are used to examine the behavior of small and large firms.

Following Gertler and Gilchrist (1993, 1994), in this research, I define small firms as those at or below the 30th percentile in total sales distribution and large firms as above the 30th percentile. According to Gertler and Gilchrist (1993, 1994), the firm size categories of the QFR data that are constructed in nominal terms are not a desirable measure of firm sizes. This is because firms can drift between categories over the sample periods due to inflation. For more detailed explanation about the 30th percentile method, refer to Appendix A.[10]

3.2.1.3 The Senior Loan Officer Opinion Survey

The Federal Reserve has released the quarterly data on the *Senior Loan Officer Opinion Survey on Lending Practice* (SLOOS) since 1964. It conducts a survey on the lending conditions of businesses and households over the past 3 months, pursuing qualitative information about changes in the bank lending practices in the U.S. credit markets. The respondents to the survey consist of up to approximately 60 large domestically chartered banks and up to 24 U.S. branches and agencies of foreign banks. The senior loan officers at respondent banks are asked about changes in terms and standards of banks' lending and about the position of business and household demand for loans. Usually, they are also questioned about other issues of current interest.

In particular, three questions in the survey pay special attention to the role of small firms and large medium-size firms in regard to commercial and industrial loans (C&I loans). In this research, small firms are defined as firms with annual sales of less than

[10] The simplest way to divide the data set into two size classes is to *eliminate* group 5 and group 6 that may be situated in a transition area between small and large groups. Then, we can refer to groups 1, 2, 3, and 4 as small firms and groups 7 and 8 as large firms. On the other hand, following Oliner and Rudebusch (1996), another way to divide the data set into two is by using the 15th percentile in capital stocks distribution instead of the 30th percentile of sales distribution.

$50 million, and large and medium-size firms are defined as those with annual sales of $50 million or more. The questions are as follows: (1) “Over the past 3 months, how have your bank’s credit standards for approving for C&I loans or credit lines to large and medium-size firms and small firms changed?”; (2) “For applications for C&I loans from large and medium-size firms and small firms that your bank currently is willing to approve, how have the terms of those loans—with respect to spread between loan rates and banks’ costs of funds—changed over the past 3 months?”; (3) “Apart from normal seasonal variation, how has demand for C&I from large and medium-size firms and small firms changed over the past 3 months?”[11]

3.2.1.4 The Business Employment Dynamics Data

The Bureau of Labor Statistics (BLS) has released the quarterly data on *Business Employment Dynamics* (BED) since 1992. The BED keeps track of *components* of the quarterly net employment change (job flows) such as gross job gains and gross jog losses in the private sector of the U.S economy. Such components of the net employment change help us to understand the underlying dynamics of the U.S. job market. The data to construct the statistics of gross job gains and losses are obtained from the Quarterly Census of Employment and Wages (QCEW). The QCEW extracts data from unemployment insurance (UI) records in 98% of nonfarm payroll business, where all employers who are subject to State unemployment insurance (UI) laws are required to submit quarterly reports about their employment and wages.

[11] The data for first two questions have been available since 1990 Q2 and the data for third question have been available since 1991 Q4. The data release can be downloaded today at the Federal Reserve’s internet website. http://www.federalreserve.gov/datadownload/Choose.aspx?rel=SLOOS

Gross job gains and gross job losses data are also available for 9 firm sizes. These firm sizes are classified according to the number of employees: size class 1 (1 to 4 employees), size class 2 (5 to 9 employees), size class 3 (10 to 19 employees), size class 4 (20 to 49 employees), size class 5 (50 to 99 employees), size class 6 (100 to 249 employees), size class 7 (250 to 499 employees), size class 8 (500 to 999 employees), and size class 9 (1000 or more employees). Because dividing the data set into small and large firms can be an issue that may affect empirical results, I aggregate those categories into small firms versus larger firms in three different ways: (1) 1 to 49 employees and 50 and more employees, (2) 1 to 99 employees and 100 or more employees, and (3) 1 to 499 employees and 500 or more employees.

3.2.2 Some Key Dates of Analysis

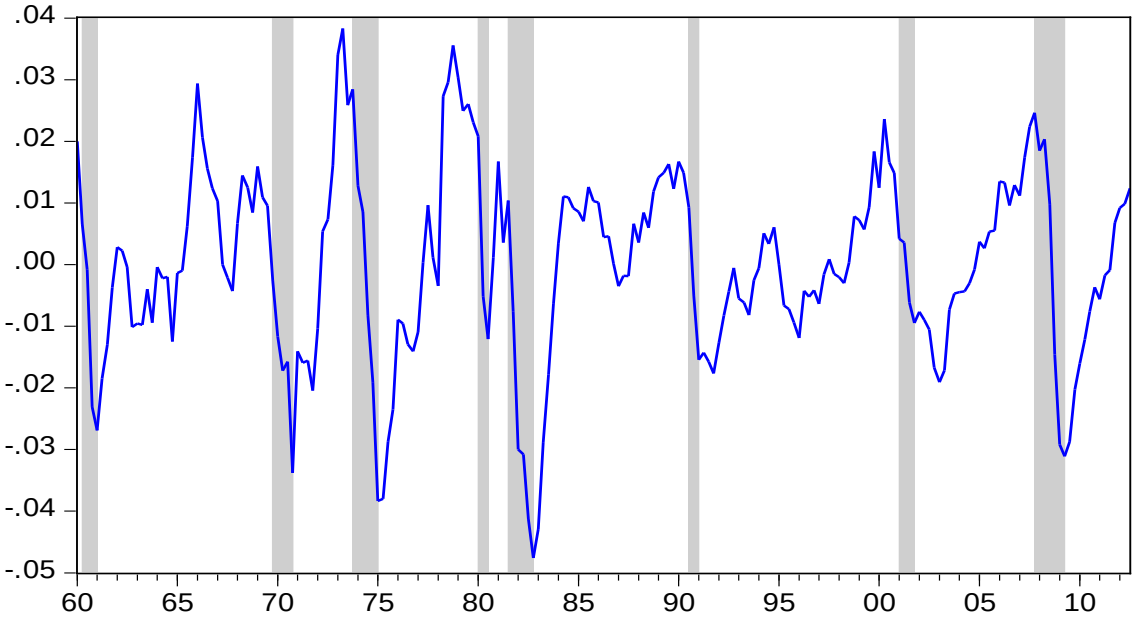
A monetary policy shock is an important source of disturbance that influences aggregate demand, and it can trigger recessions. However, not only a monetary policy shock but also "other shocks"—what we call business cycle shocks or NBER recession shocks—are disturbances that influence aggregate demand, and they can contribute to recessions as well.

To examine the behaviors of small and large firms by different episodes, our first step is to identify monetary policy shocks and business cycle shocks. Following Chari et al. (2007), I have used the "dates of business cycle peaks" as an indicator of business cycle shocks. The dates of business cycle peaks can be easily identified because the beginning dates of the recessions, which are announced by the National Bureau of Economic Research (NBER), are widely accepted and used. However, identifying the dates of the (exogenous) monetary policy shocks is somewhat controversial among

economists. Following Romer and Romer (1989), previous research frequently had used "Romer dates" as an indicator of monetary policy shocks. Yet, Romer dates are not updated since 1988. Recently, however, Adrian and Estrella (2008) have provided the "end dates for monetary tightening cycles," which can be used as a measure of monetary policy. In this analysis, therefore, I have employed Adrian dates as an indicator of monetary policy shocks.

3.2.2.1 Dates of Business Cycle Peaks

Figure 3.1 reports the result of de-trended U.S. GDP over 5 decades. The log of seasonally adjusted U.S. GDP is filtered by using the Hodrick-Prescott (HP) method to remove the trend, following Chari et al. (2007). The shaded areas are NBER recessions and indicate the starting dates (i.e., peaks of business cycles) and end dates (i.e., troughs of business cycles) of NBER recessions.



Shaded areas indicate the NBER recessions

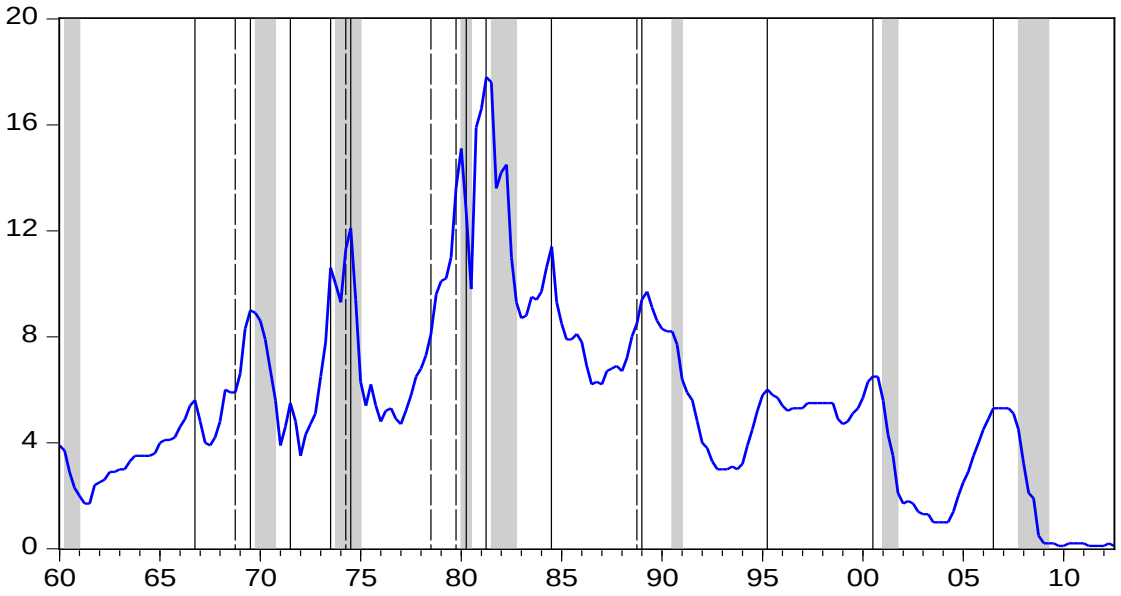
Figure 3.1 Log Deviation of U.S. GDP from HP Trend

In this empirical analysis, I have used the *starting* dates of NBER recessions as a measure of business cycle shocks in causing recessions. As shown in Figure 3.1, the starting dates of NBER recessions are 1960 Q2, 1969 Q4, 1973 Q4, 1980 Q1, 1980 Q1, 1981 Q3, 1990 Q3, 2001 Q1, and 2007 Q4. The starting dates of NBER recessions are usually observed a few quarters after "CCK dates" of business cycle peaks, which are named after Chari, Christiano, and Kehoe (2007). CCK dates of business cycle peaks are 1960 Q1, 1966 Q1, 1969 Q1, 1973 Q2, 1978 Q4, 1981 Q1, 1990 Q1, 2000 Q2, and 2000 Q4. Chari et. al (2007) used these CCK dates as a measure of business cycle shocks in their analysis. In this study, only the results of NBER dates are reported because the results produced from "CCK dates of business cycle peaks" are not materially different from results from NBER dates.

3.2.2.2 Dates of Monetary Policy Shocks

Figure 3.2 shows two different types of monetary policy shocks: Romer dates and Adrian dates. Romer and Romer (1989) carefully read the past minutes of the Federal Open Market Committees (FOMC) and picked out the beginning dates of restrictive monetary policy that were considered (exogenous) monetary policy shocks to fight against inflation. These "Romer dates" are the vertical dotted lines in Figure 3.2: 1968 Q4, 1974 Q2, 1978 Q3, 1979 Q4, and 1988 Q4.

"Adrian dates" are also used to identify monetary policy shocks. These "Adrian dates" are the vertical solid lines in Figure 3.2: 1966 Q4, 1969 Q3, 1971 Q3, 1973 Q3, 1974 Q3, 1980 Q2, 1981 Q2, 1984 Q3, 1989 Q1, 1995 Q3, 2000 Q3, and 2006 Q3. Because "Romer dates" have not existed since 1990, "Adrian dates" are employed for the long historical data of my analysis. Adrian and Estrella (2009) provide the "end



Vertical dotted lines indicate Romer Dates; Vertical solid lines indicate Adrian Dates; Shaded areas indicate the NBER recessions.

Figure 3.2 Effective Federal Funds Rate

dates of monetary tightening cycles" from 1955 to 2007. They defined the "end dates of monetary tightening cycles" in the following manner:

> We consider tightening cycles since 1955 and assume a cycle ends when either one of these criteria is met: (1) the federal funds rate is higher than at any time from 12 months before to 9 months after and is at least 50 basis points higher than at the beginning of this period, or (2) the federal funds rate is higher than at any time from 6 months before to 6 months after and is 150 basis points higher than the average at these endpoints. (Adrian & Estrella, 2009, p. 1)

There is a difference between "Romer dates" and "Adrian dates" when we consider the timing of monetary policy shocks. As shown in Figure 3.2, "Romer dates" are identified when the federal funds rate *was increasing* over the course of the upturn of the federal funds rate cycles, whereas "Adrian dates" are identified when the federal funds rate *has reached* its highest point, i.e., peaks of the federal funds rate. "Romer dates" can be considered the *beginning dates* of restrictive monetary policy because the Federal Reserve determined to increase the interest rate to slow inflation at the expense

of unemployment. “Adrian dates” can be considered the *end dates* of restrictive monetary policy because the Federal Reserve terminated its restrictive monetary policy by reducing the interest rate shortly. From 1960 Q1 to 1980 Q4, Adrian and Estrell (2009) tend to identify more occurrence of restrictive monetary policy than Romer and Romer (1989). Nonetheless, the beginning dates of restrictive monetary policy (i.e., Romer dates) overall agree with the chronology of the end dates of restrictive monetary policy (i.e., Adrian dates). In Figure 3.2, we can see that “Romer dates” are directly followed by “Adrian dates,” with an exception that two consecutive Romer dates (i.e., 1978 Q3 and 1979 Q4) are matched with one Adrian date (i.e., 1980 Q2).

3.3 Applying the Method of Previous Researchers to the Recent Data of the QFR

This section describes the procedure of data transformation to reproduce the results of previous research. In this explanation of the data, I focus on the QFR data rather than the flow of funds data. This is because, while the flow of funds data provide two separate variables for small and large firms (i.e., nonfarm nonfinancial corporate business and nonfarm noncorporate business) without requiring us to construct two variables, the QFR data require us to construct the data to produce the variables for small versus large firms.

Following the method of Gertlter and Gilchrist (1994), as discussed in Section 3, I construct each variable of small and large firms that are based on the 30th percentile of total sales distribution. Then, I deseasonalize the data. Figure 3.3 shows the growth rates of sales for small versus large firms. Since the data take the log-differenced form to create the growth rates of each firm, the 0.1 fluctuation can be interpreted as 10%

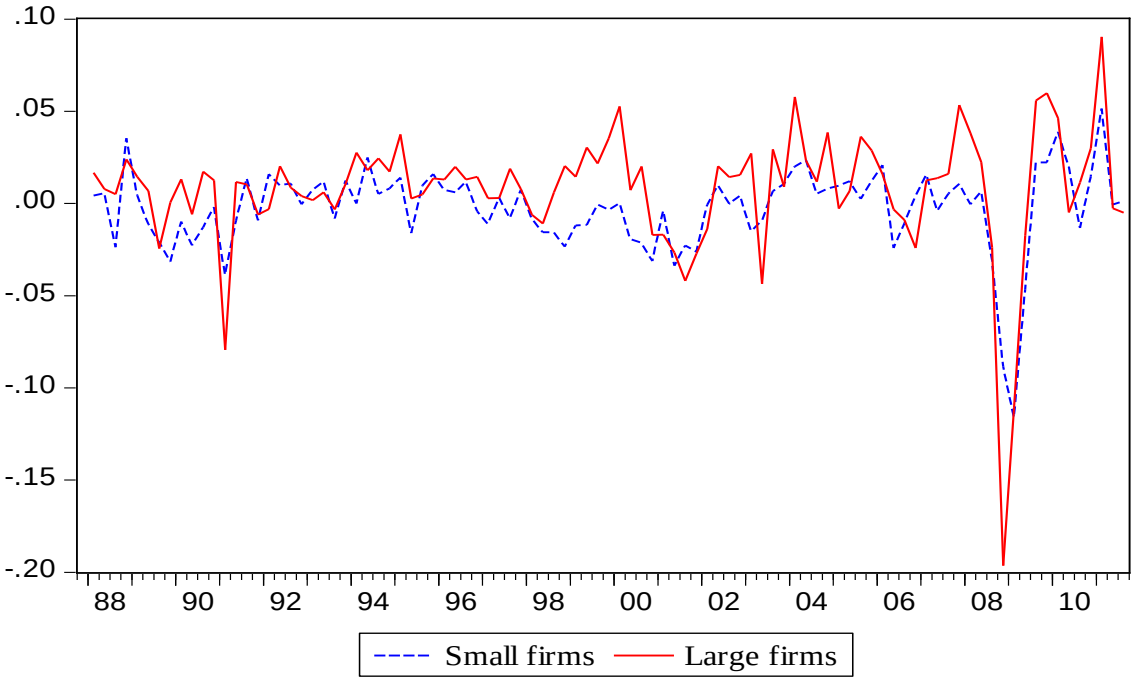


Figure 3.3 Growth Rates of Sales

growth rate of sales. In this graph, we notice that the sales growth rates of large firms fluctuate apparently more than those of small firms—especially in the neighborhood of 1998 and 2007.

By accumulating the growth rates in Figure 3.3 of small and large firms, we arrive at the results in Figure 3.4. After setting the initial condition to zero, Figure 3.4 shows the cumulative growth rates of small and large firm sales. While large firms show the upward trend of 2 decades—increasing by 80% from the initial point to the end point —small firms show the somewhat downward trend, decreasing by 40% from the initial point to the end point. [12]

[12] It is somewhat surprising that small firms show a declining pattern of behavior over time. One possible explanation is related to the characteristics of a manufacturing industry in the QFR data. Neumark, Wall, and Zhang (2008) suggest that there are different growth industrial structures and growth patterns between new and mature industries. A new industry grows fast and comprises a large share of employment growth because many new (and thus small) firms enter and exist in the industry. Conversely, a mature industry grows slowly and constitutes a small share of job growth because many small firms go

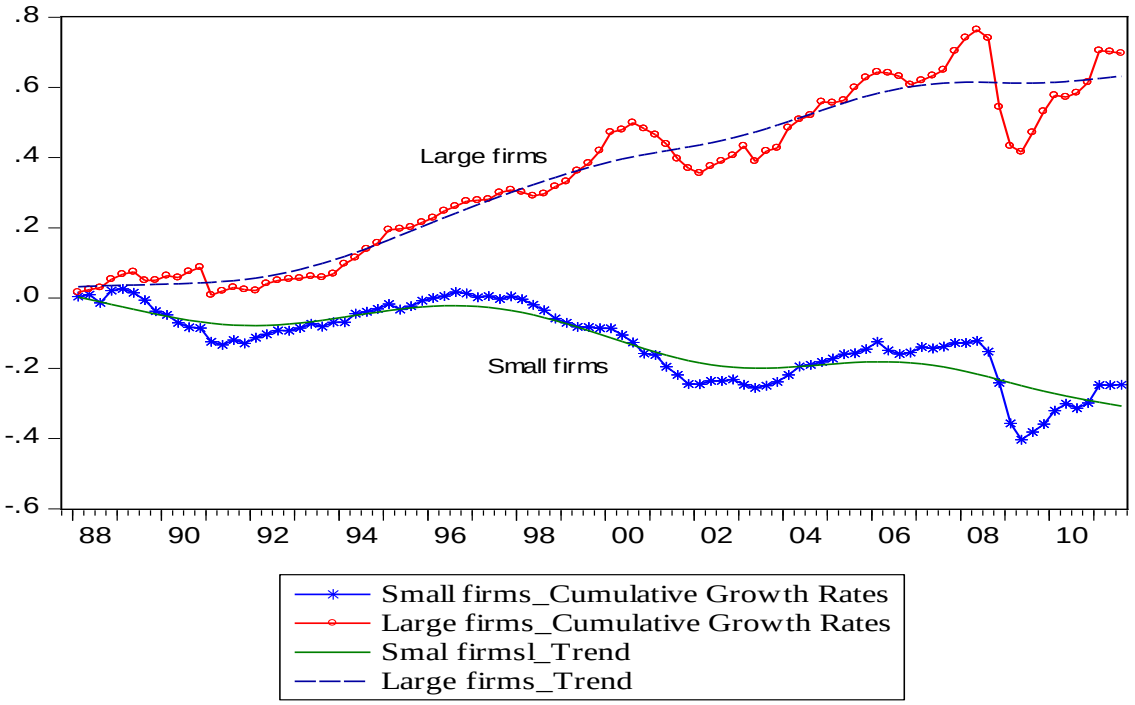


Figure 3.4 Cumulative Growth Rates of Sales

By removing the trends in Figure 3.4 of two size groups, we produce Figure 3.5. That is, Figure 3.5 displays the deviation (of cumulative growth rates) of the sales from the trend after Hodrick-Prescott (HP) filter is applied to each group of firms. In Figure 3.5, notice that, in the 2 most recent decades, the sales of large firms show more of a fluctuating pattern than those of small firms.[13]

Gertler and Gilchrist (1994) investigate the behavior of small and large firms' sales by producing a worm chart (Figure II). The worm chart draws the log deviation of small and large firms' sales from their respective value at the dates of tight monetary policy.

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out and a greater number of large firms survive in the industry. According to their suggestion, we can reason that, because the manufacturing industry is a *mature* industry where the role of small firms continues to decrease, small firms may exhibit such a declining pattern.

[13] To check the robustness of the result, I divided the data in two different ways. First, I used the *nominal cutoff* of eight groups that are made according to the nominal asset sizes. That is, small firms are the aggregation of groups 1 to 4 and large firms are aggregation of groups 7 and 8. Second, following Oliner and Rudebusch (1995), I used the *15th percentiles in capital stock distribution*, instead of the 30th percentile in sales distribution. All results show that large firms are more volatile than small firms during the last 2 decades. See Appendix B.

Figure 3.5 Cumulative Growth Rates of Sales after HP Filtering

Chari, Christiano, and Kehoe (2007) reproduce Gertler and Gilchrist's (1994) worm chart, employing a business cycle shock instead of a monetary policy shock. Following the method of Gertler and Gilchrist (1994) and Chari, Christiano, and Kehoe (2007), I investigate the sales of small and large firms after either a business cycle shock or a monetary policy shock. Therefore, the cumulative growth rates of small and large firms' sales in Figure 3.5 are normalized by zero at the date of a monetary policy shock or at the date of a business cycle peak. Then, we can produce a worm chart in the same manner as previous research.

Figure 3.6 shows the sales of small and large firms after NBER recession shocks of recent periods: 1990 Q3, 2001 Q1, and 2007 Q4. The vertical axis indicates the cumulative growth rates of sales, and the horizontal axis indicates the time periods. After an NBER recession shock, on average, the sales of large firms reduce substantially more

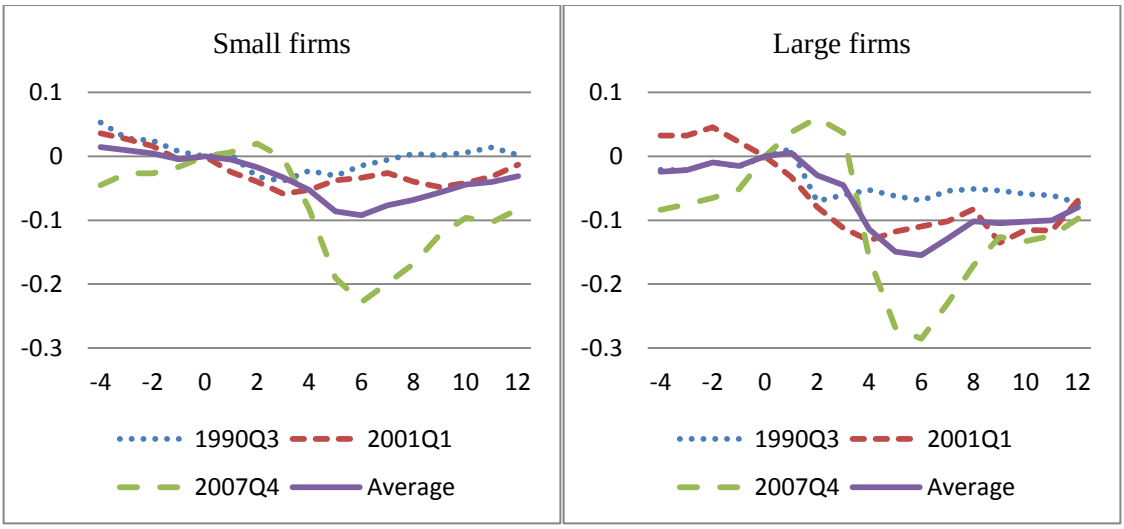

Figure 3.6 Sales of Small and Large Firms After an NBER Recession Shock

than those of small firms. In particular, after an NBER recession shock of 2007 Q4, small firms reduce their sales by 20%, whereas large firms reduce by 30%. Figure 3.7 exhibits the sales of small and large firms after monetary policy shocks of recent periods: 1995 Q2, 2000 Q3, and 2006 Q3. Particularly, after a monetary policy shock of 2003 Q3, large firms reduce their sales substantially more than small firms. Yet, after a monetary policy shock of 2006 Q3, large firms increase substantially more than small firms for a period of 6 quarters and then decrease sharply more than small firms.

Figure 3.8 shows the average sales of small and large firms after an NBER recession shock or a monetary policy shock. On average, the sales of small firms are compared to those of large firms. During *recent* periods, large firms decrease their sales substantially more than small firms after either an NBER recession shock or a monetary policy shock. Such sensitive behavior of large firms (during *recent* periods) is different from the findings of Gertler and Gilchrist (1994) (during *earlier* periods), whose study shows that small firms decrease their sales more than large firms after monetary policy shocks.

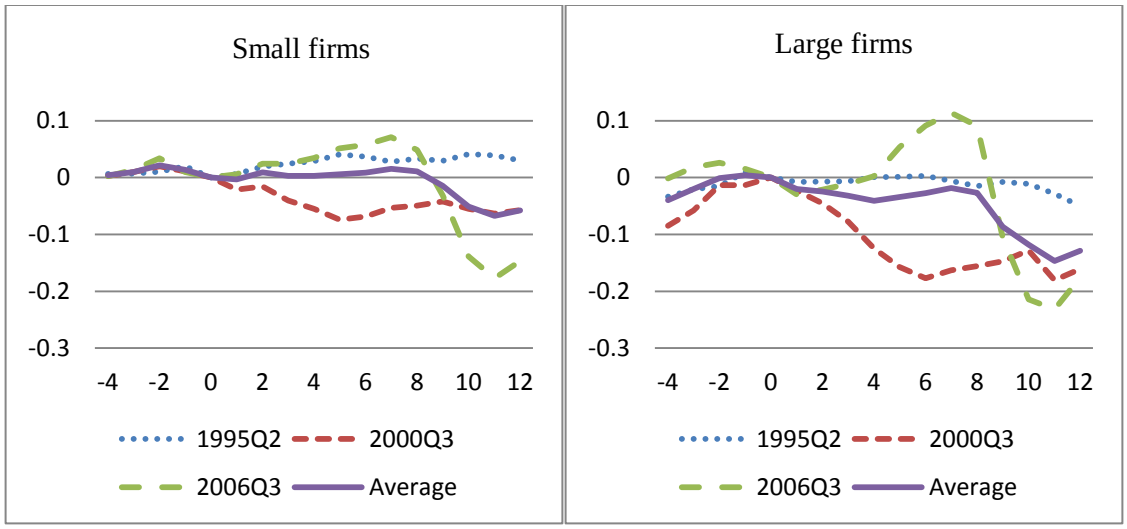

Figure 3.7 Sales of Small and Large Firms After a Monetary Policy Shock (Adrian Dates)

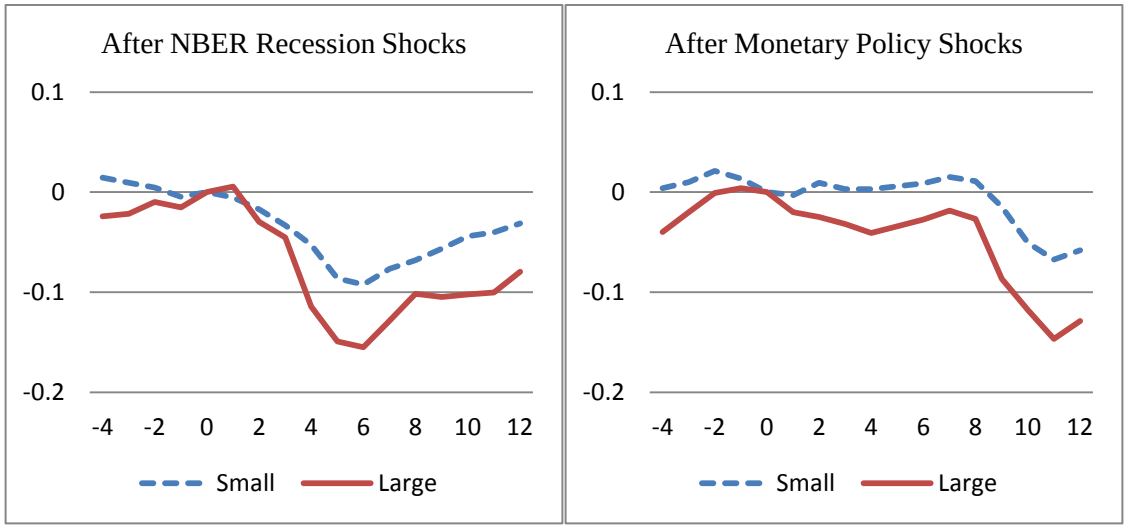

Figure 3.8 Average Sales of Small and Large Firms After Either an NBER Recession Shock or a Monetary Policy Shock

3.4 Empirical Results

This section examines the behavior of the aggregate data in some balance sheet variables (sales, inventories, trade debt, and total short-term debt) and the behavior of the components of aggregate debt (bank debt, mortgages, commercial papers and other debt). [14, 15] By using these variables, the behavior of small and large firms is explored by different episodes, business cycle episodes and monetary policy episodes, and by different periods, earlier periods and recent periods.

I report empirical results by different episodes. Empirical results of each episode cover the comparison of small and large firms' behavior between earlier periods (1960 Q1─1989 Q4) and recent periods (1990 Q1─2011 Q3).[16] In particular, the comparison of these two periods is made based on the flow of funds data because only the flow of funds data are available for this long historical time period (1960 Q1─2011 Q3) among four data sets described in Section 2—the flow of funds data, the QFR data, the SLOOS data, and BED data.

3.4.1 The Responses of Small Versus Large Firms to the NBER Recessions

I examine the behavior of small and large firms during business cycle episodes by using four different sources of data: the flow of funds data, the Quarterly Finance

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[14] Total short-term debt includes short-term bank debt, commercial papers, and short-term other debt excluding trade debt.

[15] The QFR data provide the components of *short-term debt* (i.e., short-term bank debt, commercial paper, and short-term other debt) and component of long-term debt (i.e., long-term bank debt and long-term other debt), while the flow of funds data provide only components of *aggregate debt* without the distinction between short-term and long-term debt (i.e., bank debt, mortgages, commercial papers and other debt).

[16] Earlier periods start in 1960 Q1 because the data for total short-term debt are only available from 1960 Q1.

Report (QFR) data, the Senior Loan Officer Opinion Survey (SLOOS) data, and the Business Employment Dynamics (BED) data. The results are reported in the order of data sets.

3.4.1.1 The Flow of Funds Data and the QFR Data

Employing the flow of funds data and the QFR data, Figure 3.9 shows the average changes in some balance sheet variables and in components of aggregate debt after an NBER recession shock. In particular, Figure 3.9 exhibits the outcome of the same exercise of the previous Figure 3.6 and 3.7 in terms of some balance sheet variables and the components of aggregate debt. For parsimony, I report only the *average* behavior of small and large firms after an NBER recession shock, as in Figure 3.8.

Employing the flow of funds data, the first two columns in Figure 3.9 show the average behavior of small and large firms during earlier periods (pre-1990 periods) and recent periods (post-1990 periods). Employing the QFR data, the third column shows the average behavior of small and large firms during recent periods (post-1990 periods). I report partly the results of “sales,” “short-term bank debt,” and “mortgages” because these variable are available only either for the flow of fund data or for the QFR data.

During *recent* periods in the QFR data (the third column), the sales of large firms decrease drastically more than those of small firms after an NBER recession shock. For a period of 6 quarters after an NBER recession shock, the sales of large firms decline by roughly 15%, but small firms decline by roughly 10%. During *earlier* periods in the flow of funds data (the first column), the inventories of small and large firms show somewhat different responses after an NBER recession shock. Large firms tend to decrease their inventories more slowly than small firms after an NBER recession shock.

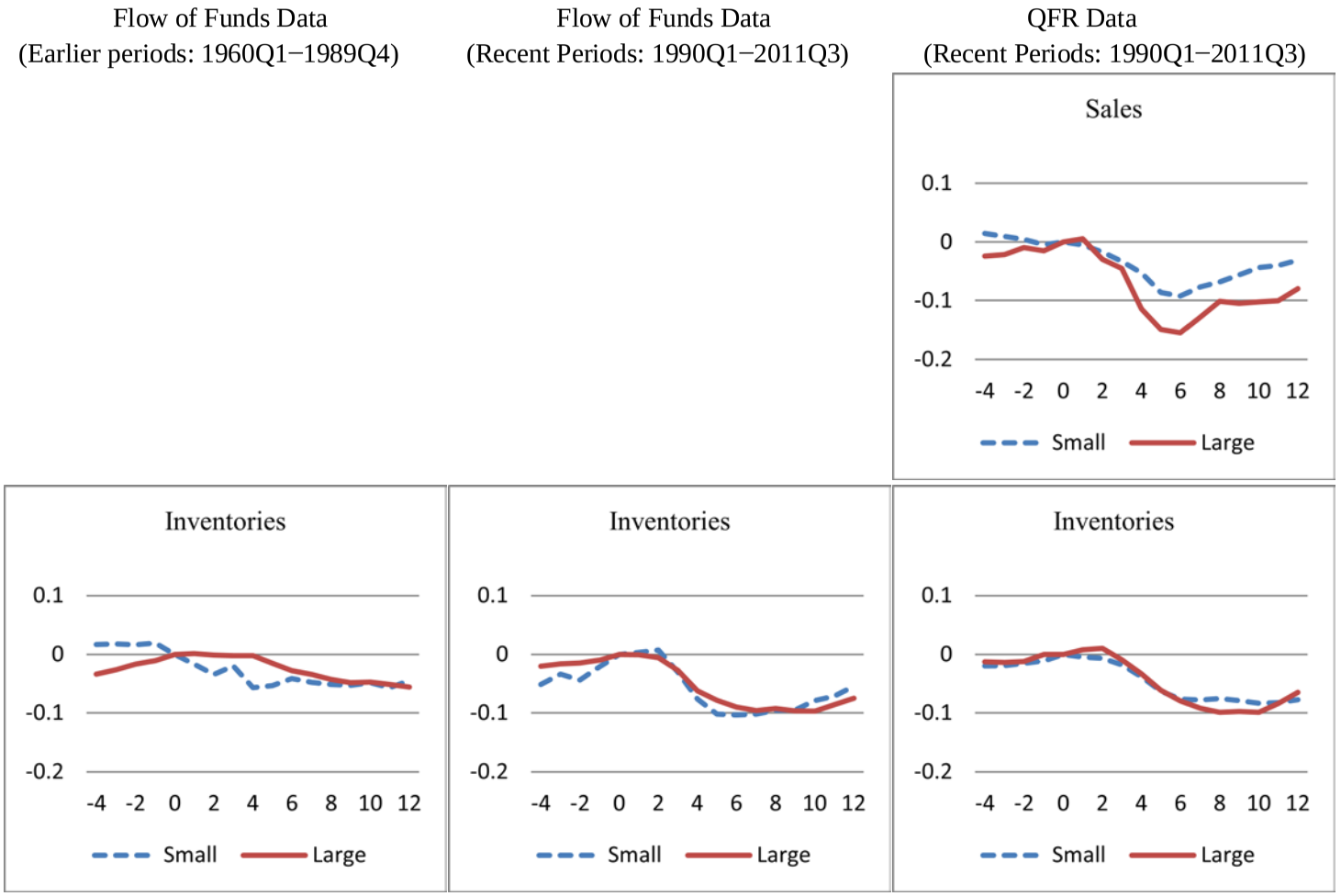


Figure 3.9 Average Changes in Sales and Some Balance Sheet Variables After an NBER Recession Shock

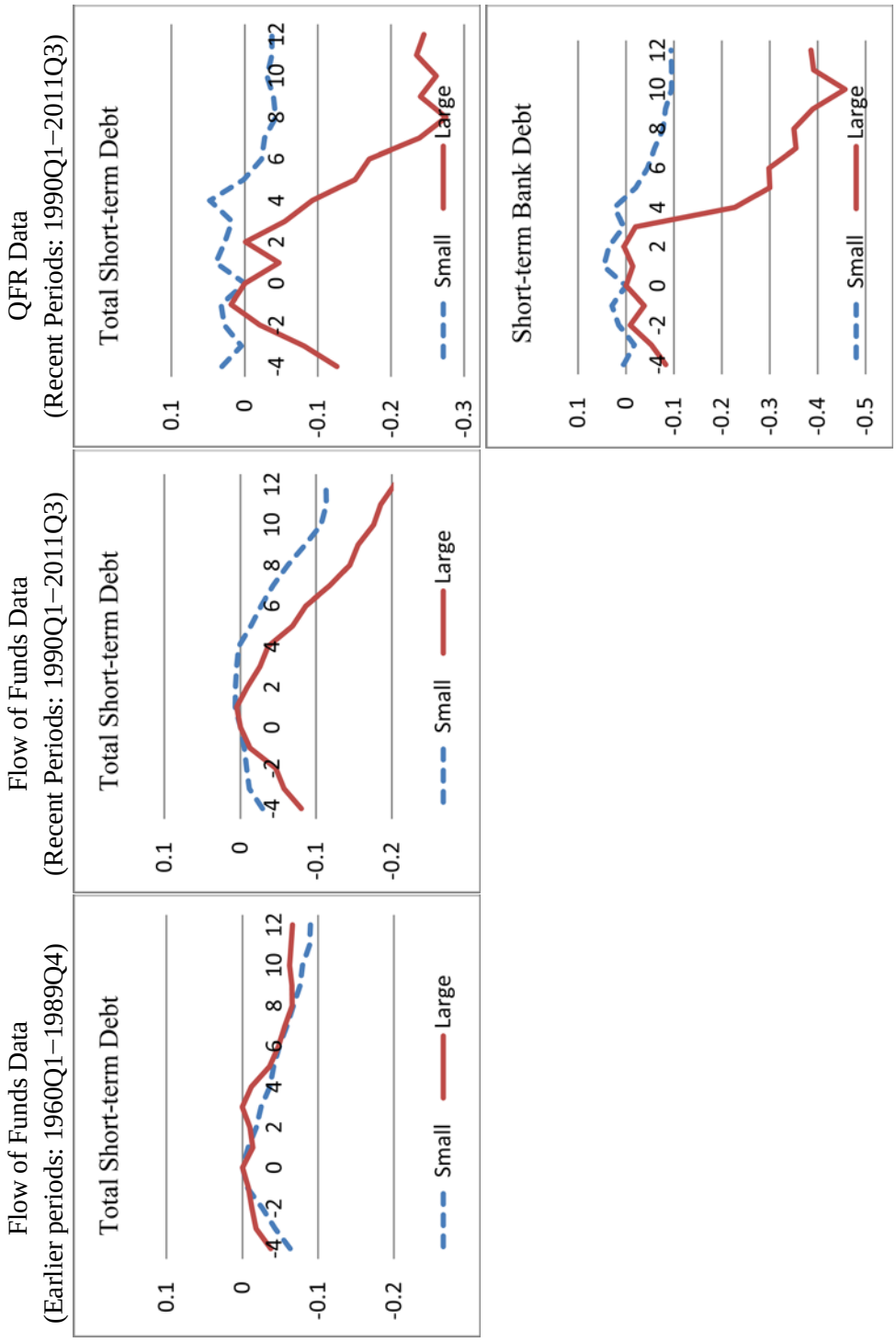
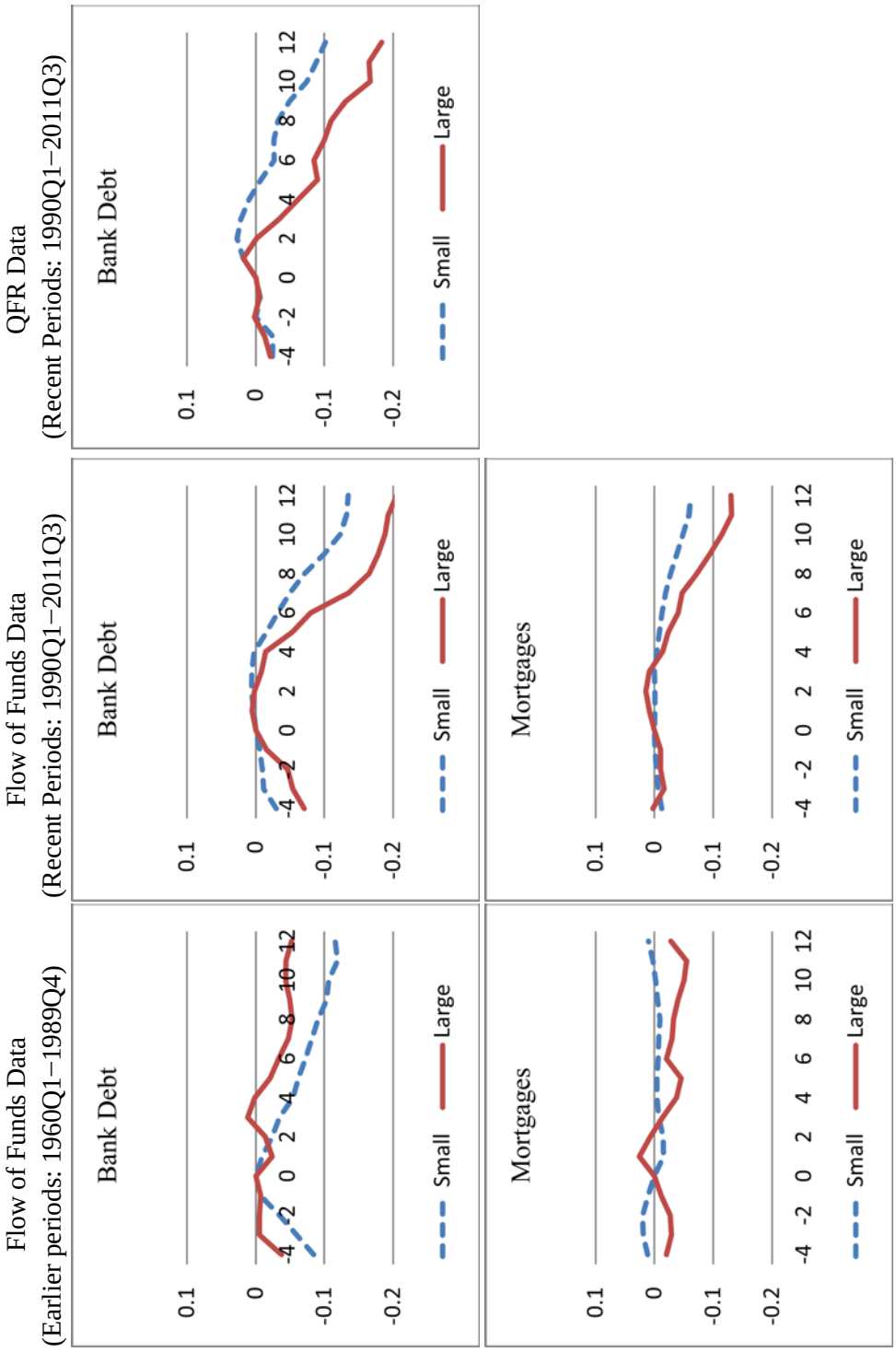


Figure 3.9 Continued



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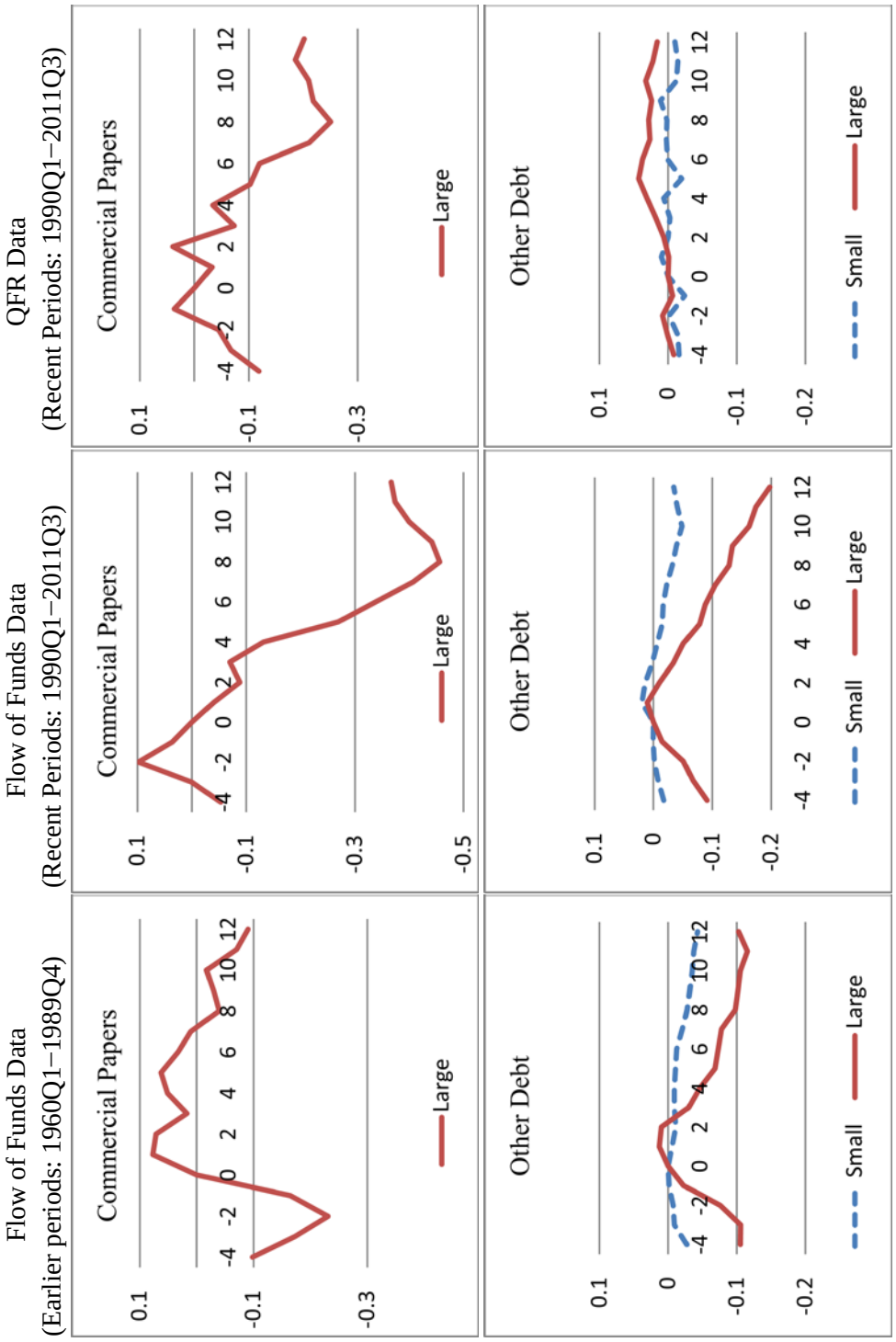

Figure 3.9 Continued

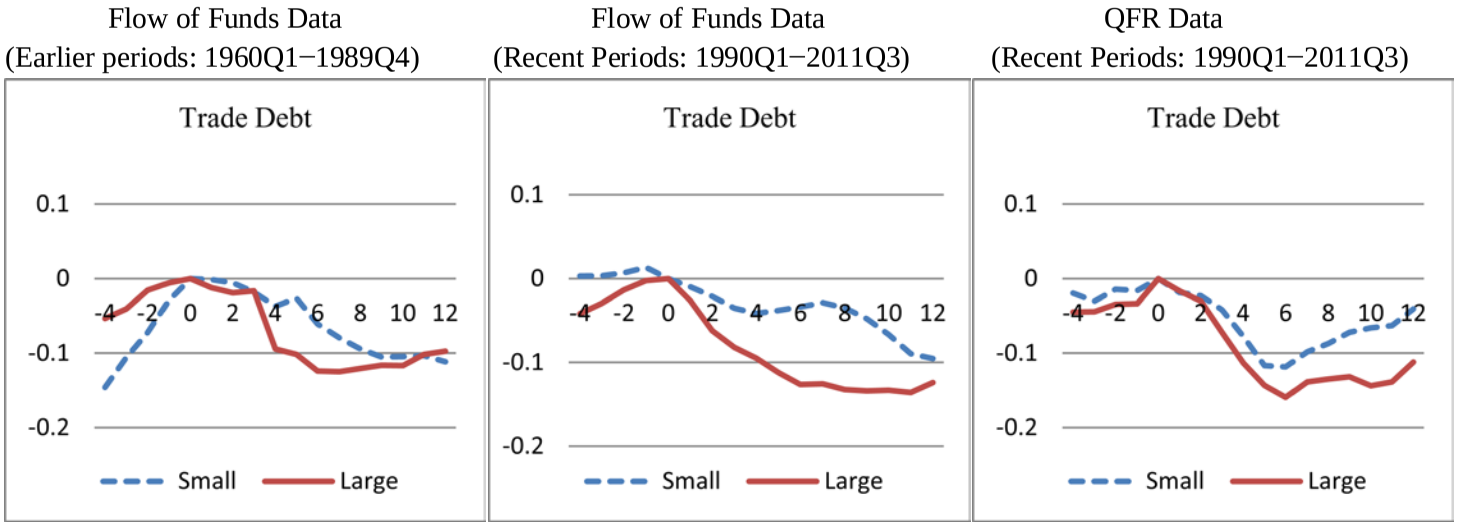

Figure 3.9 Continued

However, during recent periods in the flow of funds and the QFR data (second and third columns), the inventories of small and large firms show almost the same responses after an NBER recession shock. For a period of 6 quarters after an NBER recession shock, both small and large firms decrease their inventories by roughly 10%.

During *earlier* periods in the flow of funds data (the first column), the total short-term debt of small and large firms exhibits somewhat similar responses after an NBER recession shock. Both small and large firms slowly decrease their total short-term debt in a similar way by less than 10%. Yet, during *recent* periods in the flow of funds and the QFR data (the second and third columns), the total short-term debt of large firms drops substantially more than that of small firms. In particular, in the flow of funds data, large firms reduce their total short-term debt by roughly 18% for a period of 10 quarters after an NBER recession, but small firms reduce it by 10%. Such substantial reduction of short-term debt in large firms is more pronounced in the QFR data than in the flow of funds data. In the QFR data, large firms decline their total short-term debt by roughly 25% for a period of 10 quarters after an NBER recession shock, but small firms reduce it by roughly 5%.[17]

The components of aggregate debt exhibit a similar pattern to total short-term debt, depending on different time periods. During earlier periods, both small and large firms reduce total short-term debt comparably, whereas during recent periods, large firms reduce total short-term debt substantially more than small firms. Likewise, during earlier periods, both small and large firms, in general, similarly reduce the components

[17] During recent periods, such substantial reduction of large firms is more clearly shown in short-term bank debt of the QFR data. Large firms decrease short-term bank debt by about 45%, but small firms decrease by about 10%.

of aggregate debt, while during recent periods, large firms reduce the components of aggregate debt substantially more than small firms.

During earlier periods in the flow of funds data (the first column), the components of aggregate debt show somewhat similar responses after an NBER recession shock. The bank debt of small firms decreases slightly more than that of large firms; the mortgages and other debt of small firms decrease slightly less than those of large firms. However, during recent periods in the flow of funds data and the QFR data (the second and third column), the components of short-term debt shows that the bank loans, mortgages and other debt of large firms—except the other debt of the QFR data—decrease substantially more than those of small firms after an NBER recession.

When the components of aggregate debt during earlier periods are compared to those during recent periods in the flow of funds data (the first and second columns), the bank loan, mortgages, commercial papers, and other debt of large firms during recent periods (the second column) decrease substantially more than those of large firms during earlier periods (the first column). In particular, the commercial papers of large firms decrease during recent periods considerably more than during earlier periods. For a period of 8 quarters after an NBER recession shock, large firms reduce the commercial papers by around 5% during earlier periods, but reduce them by around 35% during recent periods.

During recent periods (the second and third columns), when the flow of funds data are compared to the QFR data for all applicable variables, all variables except other debt (i.e., inventories, total short-term debt, bank debt, commercial and trade debt) display similar results. Generally, large firms reduce these variables significantly more

than small firms. The other debt of small firms shows somewhat different behavior between the flow of funds and the QFR data.[18] The trade debt of large firms decreases more than that of small firms in all datasets and in all different periods (the first, second, and third columns).

The main finding is that during recent periods, in general, some balance sheet variables and components of aggregate debt in large firms decrease substantially more than those of small firms after an NBER recession shock. In particular, total short-term debt reflects this phenomenon very well. The declining pattern of total short-term debt in large firms is more pronounced in the QFR data than in the flow of funds data.

3.4.1.2 The Senior Loan Officer Opinion Survey Data

The Senior Loan Officer Opinion Survey (SLOOS) data are other sources of data we can use to examine the behavior of small and large firms. As stated in Section 2, the Federal Reserve conducts surveys to find out how the senior loan officers (at each respondent banks) feel about their lending practices—such as changes in the standards and terms of bank loans—in the credit market over the past 3 months. For the questions that examine banks' lending standards and banks' lending terms,[19] respondents (i.e.,

[18] The different behavior of other debt in small firms—between the flow of funds and the QFR data during recent periods—may result from the somewhat different characteristics of other debt in each set of the flow of funds and the QFR data. Other debt is defined as the *residual* of total debt after subtracting the components of debt from the total debt in each set of data. Because the components of debt in the flow of fund data are different from those in the QFR, other debt in the flow of funds data is different from that in the QFR data. In the flow of funds, other debt includes foreign debt, debt from saving institutions and credit unions, finance companies and so on (Federal Reserve, 2000). However, short-term other debt in the QFR data includes mortgages, nonbank financial institutions' debt, and so forth. Notice that mortgages are categorized as other debt in the QFR, whereas they are not categorized as other debt in the flow of funds data.

[19] To reiterate, the question about banks' lending standards is "How have your credit standards for C&I loans to small firms and large and medium-size firms changed over the past 3 months?" The question about banks' lending terms is "How have the terms of C&I loans to small firms and large and

senior loan officers at banks) can answer the questions with one of the five given choices: (1) Tightened considerably, (2) tightened somewhat, (3) remained basically unchanged, (4) eased somewhat, and (5) eased considerably. Also, for the question about the state of business demand for loans,[20] respondents can answer the questions with one of the five given options: (1) Substantially stronger, (2) moderately stronger, (3) about the same, (4) moderately weaker, and (5) substantially weaker.

Figure 3.10 shows the net percentage of domestic respondents that report a tightening of loan *standards* for commercial and industrial (C&I) loans. The net percentage tightening here is defined as the number of loan officers reporting tightening standards ("tightened considerably" or "tightened somewhat") minus the number

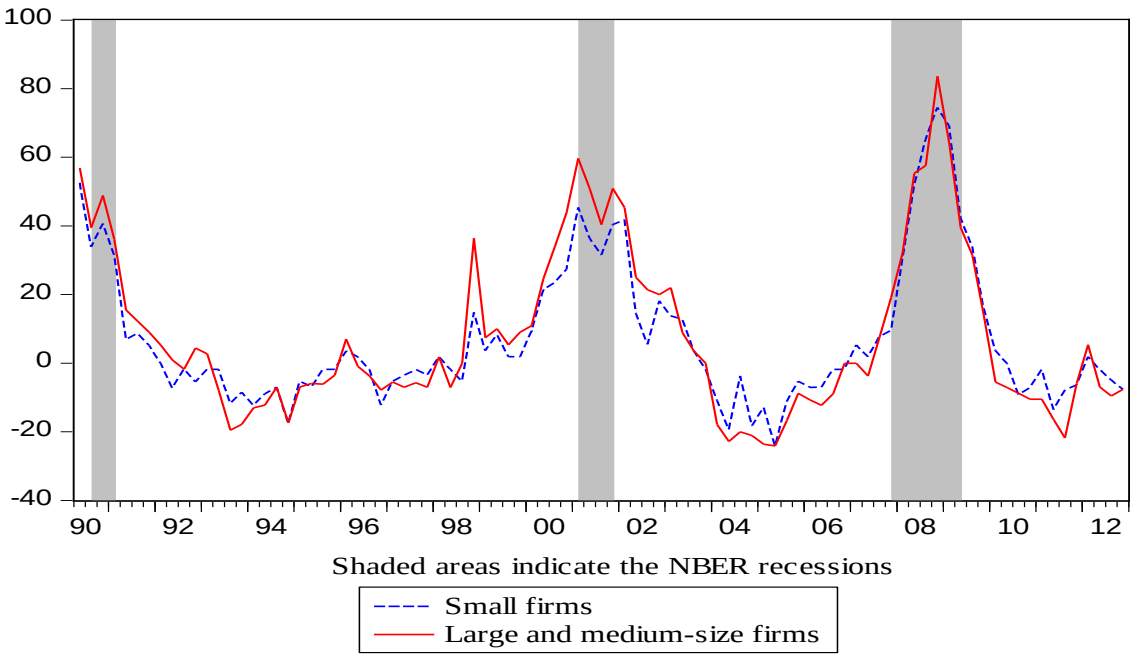

Figure 3.10 Net Percentage of Domestic Respondents Tightening Standards for C&I Loans

medium-sized firms—with respect to spread of loan rates over banks' costs of funds—changed over the past 3 months?"

[20] The question about the state of business demand for loans is "Apart from normal seasonal variation, how has demand for C&I loans from large and medium-size firms and small firms changed over the past 3 months?"

reporting easing ("eased considerably" or "eased somewhat") divided by the total number reporting. Although a tightening of loan standards in "small firms" and "large and medium-size firms" tends to rise and fall in a similar way over the sample periods, senior loan officers report that they increase their loan standards to large and medium-size firms more than to small firms during *all* three NBER recessions. In particular, during the 2001 recession, banks increased their standards to large and medium-size firms *substantially* more than to small firms. Yet, during the recessions of 1990 to 1991 and of 2007 to 2009, they increased to large and medium-size firms *slightly* more than to small firms.

Figure 3.11 shows the net percentage of domestic respondents that report an increase in loan *spreads* between loan rates and banks' cost of funds for C&I loans. A wider spread of loan rates over cost of funds indicates that a bank tightens its lending practices, and a narrower spread indicates that a bank eases its lending practices.

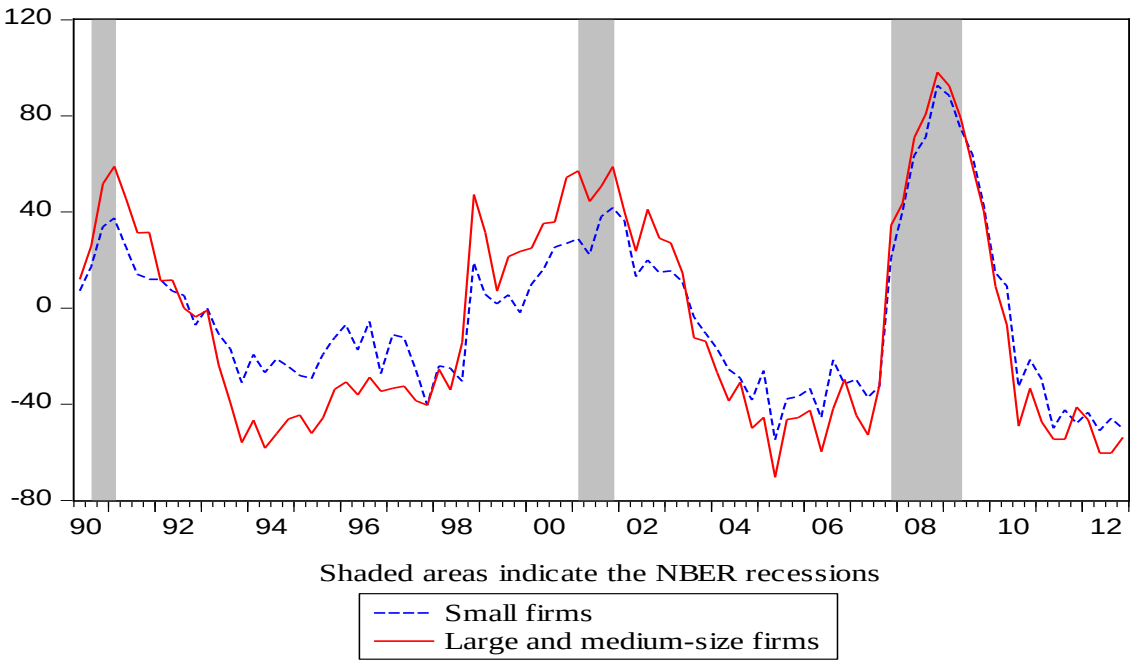

Figure 3.11 Net Percentage of Domestic Respondents Increasing Spreads of Loan Rates over Banks' Cost of Funds

Similarly, the net percentage spreads are defined as the number of loan officers reporting an increase in loan spreads ("tightened considerably" or "tightened somewhat") minus the number reporting an decrease in loan spreads ("eased considerably" or "eased somewhat") divided by the total number reporting. Increases or decreases in loan spreads to large and medium-size firms are noticeably more volatile than the correspondence to small firms over the business cycles. Such different fluctuations suggest that during a contraction, banks increase their loan spreads to large and medium-size firms substantially more than to small firms; during an expansion, they also decrease to large and medium-size firms significantly more than to small firms. While banks increased very similarly their loan spreads between these two kinds of firms during the recession of 2007 to 2009, they nevertheless increased their loan spreads to large and medium-size firms considerably more than to small firms during the recession of 1990 to 1991 and the 2001 recession.

Figure 3.12 shows the net percentage of domestic respondents that report a stronger *demand* of businesses for C&I loans. Likewise, the net percentage demand is defined as the number of loan officers reporting a stronger demand of business ("substantially stronger" or "moderately stronger") minus the number reporting a weaker demand of business ("substantially weaker" or "moderately weaker") divided by the total number reporting. We can observe a similar pattern in loan demand of businesses from what happen to the banks' lending standards and terms. A stronger loan demand to large and medium-size firms tends to fluctuate more than the equivalence to small firms over the sample periods. Such variations suggest that during a contraction, large and medium-size firms increase their demand for credit more than small firms; during an expansion,

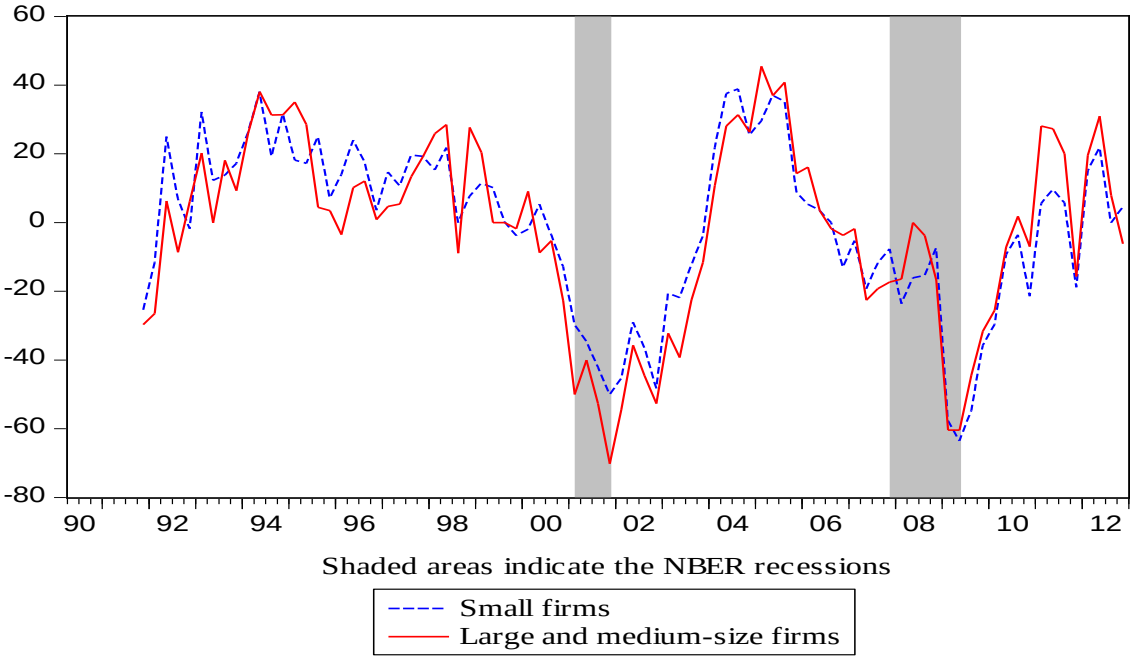

Figure 3.12 Net Percentage of Domestic Respondents Reporting Stronger Demand for C&I Loans

they decrease their demand for credit more than small firms. In particular, banks perceive that "small firms" and "large and medium-size firms" decrease very comparably their demand during the recession of 2007 to 2009, but banks perceive that large and medium-size firms decrease their demand significantly more than small firms during the 2001 recession—the data of the 1990 recession are not available in this net percentage demand.

3.2.1.3 The Business Employment Dynamics Data

The BED data also can be used to examine the behavior of small and large firms in terms of employment. Although Birch (1979) finds that small businesses account for a particularly large share of new jobs created in the U.S economy (reporting that establishments with 100 or fewer employees create 81.5% of net new jobs between 1960 and 1976), a number of researchers cast doubt on his finding. They suggest that

his finding is somewhat overestimated for the role of small firms in job creation. Armington and Odle (1982) find that, when they classify business sizes by the number of employees working for *firms* (i.e., a firm basis) rather than the number of employees working at each location (i.e., an establishment basis),[21] firms with 100 or fewer employees generate only 39% of net jobs between 1978 and 1980. Brown, Hamilton, and Medoff (1990) find that 40% of jobs possessed by small businesses in 1980 had disappeared after 6 years, which implies that small businesses tend to produce short-lived jobs. They claim that small businesses are not responsible for such a large share of jobs when we pay attention to jobs that are not short-lived. Furthermore, Davis, Haltiwanger, and Schuh (1998) criticize Birch's methodology of classifying businesses into size categories because Birch's approach produces an upward bias in the contribution of small firms to job growth. They point out that, when Birch uses base-year employment in the denominator in the calculation of job growth rate, the base-year employment leads to a statistical pitfall, which indicates that employment growth is stemming from small firms. This is known as the "regression fallacy" or "regression-to-the-mean" bias.

To deal with some of the problems described above, the BED begins providing the data of business size categories in a different way. Business sizes are classified by the *firm* level (instead of the establishment level), and an alternative method, known as "a dynamic-sizing method," is used (instead of the base-year method) when the BED classifies businesses into size classes. In addition to providing more accurate data, the

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[21] "An establishment is typically defined as an economic unit, such as a factory or store, which produces goods and provides services. An establishment is a physical location and is engaged in one, or predominantly one, type of economic activity. In contrast, a firm is defined as an aggregation of establishment under common ownership by a corporation parent" (Okolie, 2004, p. 4).

BED also provides the decomposition data of net employment growth, which allow us to understand the dynamics of the job market in more depth. In the quarterly BED data series, the net employment change is decomposed mainly into “gross job gains” and “gross job losses.” Gross job gains are divided furthermore into business openings and expansions. Gross job losses are divided additionally into business closings and contractions.

Based on the BED data from 1992 Q2 to 2011 Q4, Table 3.1 displays the quarterly average of gross job gains, gross job losses, and net changes by firm sizes. The job gains, job losses, and net changes are reported basically in three different ways: level (panel A), share (panel B), and growth rate (panel C). As shown in panel A, the employment level data show that the economy, on average, created a total of 251,000 jobs each quarter over the sample periods. Such employment increase is the net result of two factors: the jobs created by business openings and expansions and the jobs lost by business closings and contractions. Opening and expanding businesses created an average of 6.3 million jobs each quarter, whereas closing and contracting businesses lost an average of 6.1 million jobs. Each of these figures is much large than the net employment figures, 251,000. These statistics indicate the substantial number of job *churning* that happens in the U.S economy every quarter.

More specifically, as to gross job gains, employment expanding businesses increased by an average of 5.3 million jobs per quarter, and employment opening businesses increased by an average of 1 million jobs. Expanding businesses, consequently, account for about 84% of gross job gains each quarter (5.3 million jobs/6.3 million jobs), and opening businesses account for remaining about 16% (1

Table 3.1 Average Quarterly Level, Share, and Growth Rate of Gross Job Gains and Gross Job Losses by Firm Size (seasonally adjusted, 1992 Q3 to 2011 Q4)

Categories	Size Classes (Number of Employees)										
	(1) 1 to 4	(2) 5 to 9	(3) 10 to 19	(4) 20 to 49	(5) 50 to 99	(6) 100 to 249	(7) 250 to 499	(8) 500 to 999	(9) 1000 or more	(10) Total	(11) Aver -age
A. Level (in Thousand)											
Gross Job Gains	944	739	761	904	572	612	369	302	1,130	6,333	—
Expansions	379	573	643	809	533	586	359	296	1,122	5,301	—
Openings.	565	166	117	95	39	26	10	6	8	1,032	—
Gross Job Losses	925	727	743	874	547	578	347	285	1,058	6,082	—
Contractions	389	569	630	779	505	546	333	276	1,049	5,075	—
Closings	536	158	113	95	42	32	14	8	10	1,007	—
Net Change	19	13	18	30	25	34	22	17	72	251	—
B. Share (Percent of the Categories) [1]											
Gross Job Gains	15	12	12	14	9	10	6	5	18	100	—
Expansions	7	11	12	15	10	11	7	6	21	100	—
Openings	55	16	11	9	4	3	1	1	1	100	—
Gross Job Losses	15	12	12	14	9	9	6	5	17	100	—
Contractions	8	11	12	15	10	11	7	5	21	100	—
Closings	53	16	11	9	4	3	1	1	1	100	—
Net Change	8	5	7	12	10	14	9	7	29	100	—
Cumulative Share of Net Change	8	13	20	32	42	56	64	71	100	—	—
C. Growth Rate (Percent of Total Employment) [2]											
Gross Job Gains	17.3	11.3	9.4	7.7	6.5	5.5	4.8	4.2	2.9	—	7.7
Expansions	6.9	8.8	7.9	6.9	6	5.3	4.7	4.1	2.9	—	5.9
Openings	10.3	2.5	1.4	0.8	0.4	0.2	0.1	0.1	0	—	1.8
Gross Job Losses	16.8	11.1	9.1	7.4	6.1	5.1	4.5	3.9	2.7	—	7.4
Contractions	7.1	8.7	7.7	6.6	5.7	4.9	4.3	3.8	2.6	—	5.7
Closings	9.8	2.4	1.4	0.8	0.5	0.3	0.2	0.1	0	—	1.7
Net Change	0.4	0.2	0.3	0.3	0.3	0.4	0.3	0.3	0.2	—	0.3

[1] Share measures the percent of the categories—i.e., gross job gains, expansions, contractions etc.—represented by each firm class.
[2] Growth rate measures the gross job gains, gross job losses, expansions, openings, contractions and openings as a percentage of average of the previous and current total employment.
†Source: An author' calculations based on Bureau of Labor Statistics' Business Employment Dynamics dataset. Some percentages do not total 100 due to rounding.

million jobs/6.3 million jobs)—on average over the sample period. On the other hand, regarding gross job losses, employment contracting businesses decreased by an average of 5.1 million jobs, and employment closing businesses decreased by an average of 1 million jobs. Contracting businesses, hence, account for about 84% of gross job losses, and closing businesses account for the residual about 16%—on average over the sample period. These statistics indicate that it is expanding and contracting businesses that constitute a majority of gross job gains and losses in the labor market, not opening and closing businesses.

As previously reported, the economy has experienced gross job gains, averaging a gain of 6.3 million jobs each quarter. A natural question arises: "Which firm size group accounts for the most job gains?" Panel B answers this question. Firms with fewer than 50 employees contributed an average of 53% of gross job gains (15+12+12+14), and firms with fewer than 100 employees contributed 62% (53+9). On the other hand, the economy has experienced gross job losses, averaging a loss of 6.1 million jobs each quarter. Firms with fewer than 50 employees had a 53% share of gross job losses (15+12+12+14), and firms with fewer than 100 employees had a 62% share of gross job losses (53+9). Subtracting gross job losses from gross job gains produces an average *net gain* of 251,000 jobs. Firms with fewer than 50 employees contributed about 32% of average net job change, and firms with fewer than 100 employees contributed 42%. To understand whether small firms create more jobs than large firms, it is required to compare the share of small firms in total job creation to the share of their *total employment*. The comparison of these two shares reveals that the share of these firms in total job creation is greater than the share of their total employment. Firms with fewer

than 50 employees made up 30% of total employment (but contributed 32% of net job creation), and firms with fewer than 100 employees made up 37% (but contributed 42%)—the share of total employment is not shown in Table 3.1.[22] These statistics suggest that small firms contributed a larger share of new jobs over the past 2 decades[23]—nonetheless, a larger share of their new jobs is still open to question over the phase of the business cycle, especially during a recession.

The very large firms, those with 1000 or more employees, made up 18% of gross job gains, the highest share among the nine size firms. The next largest share appears with the size class 1 to 4 employees, with 15% of gross job gains. These two size groups also had the largest quarterly share of gross job losses, 17% and 15%, respectively. The business openings and closings took place mostly in smaller size groups. In the size class of 1 to 4 employees, the average share of gross job gains was 55% each quarter, and the average share of gross job losses was 53%. Notice that this share decreases as firm size increases.

As shown in panel C, the growth rates show that the economy has experienced about 7.7% of average gross job gain rate and about 7.4% of average gross job loss rate over the sample periods. These figures mean that the jobs created by opening and expanding businesses account for average 7.7% of the *total* number of jobs during a quarter; similarly, the job lost by closing and contracting businesses comprise average

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[22] The share of total employment (not shown in Table 3.1) is based on the establishment level, not the firm level, from the data of Business Dynamic Statistics (BDS).

[23] Brown et al. (1990) suggest that we should not conclude from this result—the larger contribution of small firms to new jobs—that small firms grow faster than larger ones. Indeed, the mortality rate for small firms is much higher than that of large firms. Such high mortality rate influences the faster growth rates of small firms among survivors. "If calculation [of growth rate] is extended to include all firms existing in the initial year, and not just those that survived, small businesses declined faster than large ones" (p. 24).

7.4% of *total* number of jobs. The difference of 3% between these two statistics is an average of net employment growth rate during a quarter. In this analysis, we will pay special attention to the net employment growth measured as a *rate*, rather than an employment level, because using an employment growth rate permits us to compare changes in the behavior of small and large firms more reasonably. To understand better the underlying dynamics of the net employment growth rate, we need to turn to the components of the net employment growth measured as rates—a gross job gains rate and a gross job losses rate.

Figure 3.13 shows gross job gain (job creation) rates and gross job loss (job destruction) rates between small and larger firms. In this graph, small firms are defined as firms with 1 to 49 employees, and large firms are defined as those with 50 or more.[24, 25] Over the past 2 decades, we can see a striking difference of job creation rates and destruction rates between small and large firms. Both the job creation rates and job destruction rates of small firms are very high, ranging from 9 to 13%. In contrast, these two statistics of large firms are somewhat low, ranging from 3 to 6%. Such a different tendency suggests that small firms create and also destruct jobs at a fast rate, while large firms create and also destruct jobs at a slow rate.[26] Because an important statistic we

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[24] I report only the results produced by this definition of small and large firms because other two definitions—which indicate small firms as those with 1 to 99 employees and those with 1 to 499 employees—produce similar results.

[25] Job gain rates are measured by averaging the job gain rates of each size classes of small and large firms according to the definition of each group of firms. For example, when small firms are defined firms with 1 to 49, I first calculate the job gain rates of each of the first four size classes. Then, I divide the sum of the job gain rates of these four size classes by 4, i.e., (the rate of size class 1 + of size class 2 + of size class 3 + of size class 4)/4.

[26] Although I did not report expansion rates, contraction rates, opening rates, and closing rates, the behavior of these components reflects a pattern of job creation rates and job destruction rates between small and large firms. That is, existing small firms tend to expand and contract jobs at the higher rate than

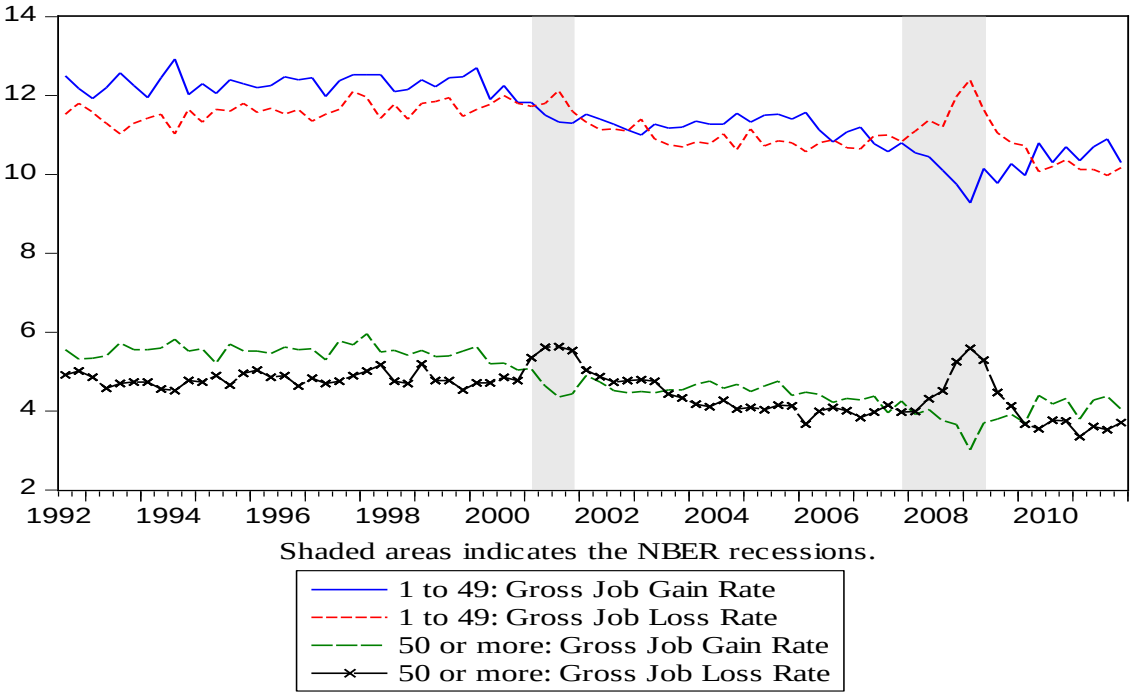

Figure 3.13 Gross Job Gain Rates and Gross Job Loss Rates

must focus on is the difference between job creation rates and destruction rates, this leads us to investigate *net* job creation rates, a more accurate measure of job creation in the economy.

Figure 3.14 shows the behavior of both the net job creation (levels) and the net job creation rate between small and large firms from 1992 Q3 to 2011 Q4. To examine the behavior of small and large firms more thoroughly in terms of net job creation, small and larger firms are defined in three different ways, as stated in Section 2: (1) small firms are a group that hires 1 to 49 employees, and larger firms are a group that hires 50 or more employees; (2) small firms are a group that hires 1 to 99 employees, and larger firms are a group that hires 100 or more employees; and (3) small firms are a group that hires 1 to 499 employees, and larger firms are a group that hires 500 or more employees.

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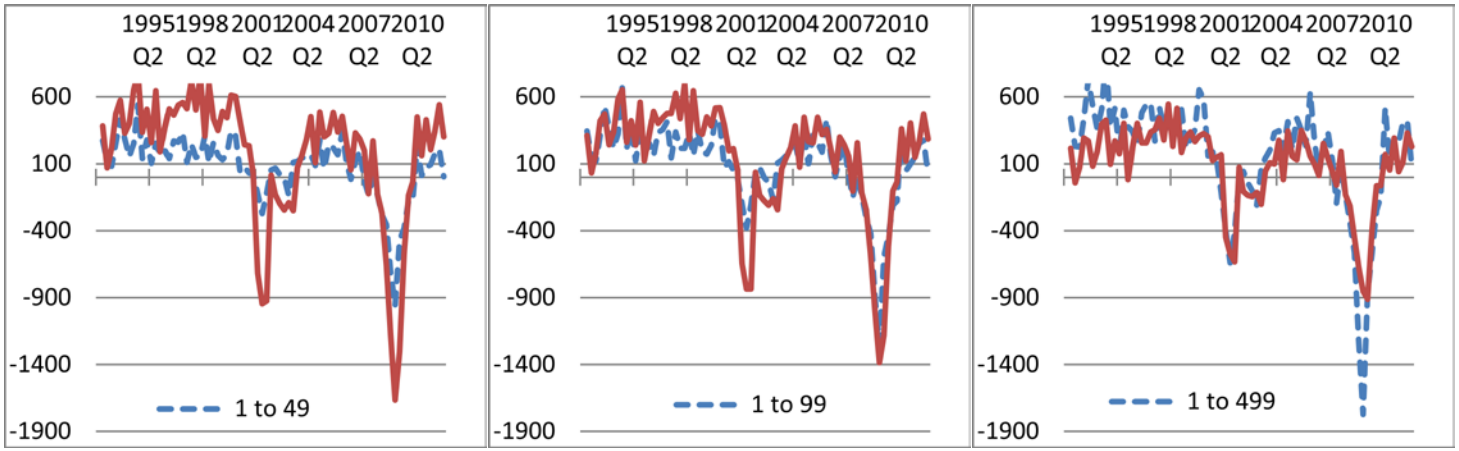
existing large firms do; small firms tend to open and close their businesses at a greater rate than large firms do.

Panel A: Net Job Creation (in Thousand)



Panel B: Net Job Creation Rates after HP Filtering from Cumulative Growth Rate (Percent)

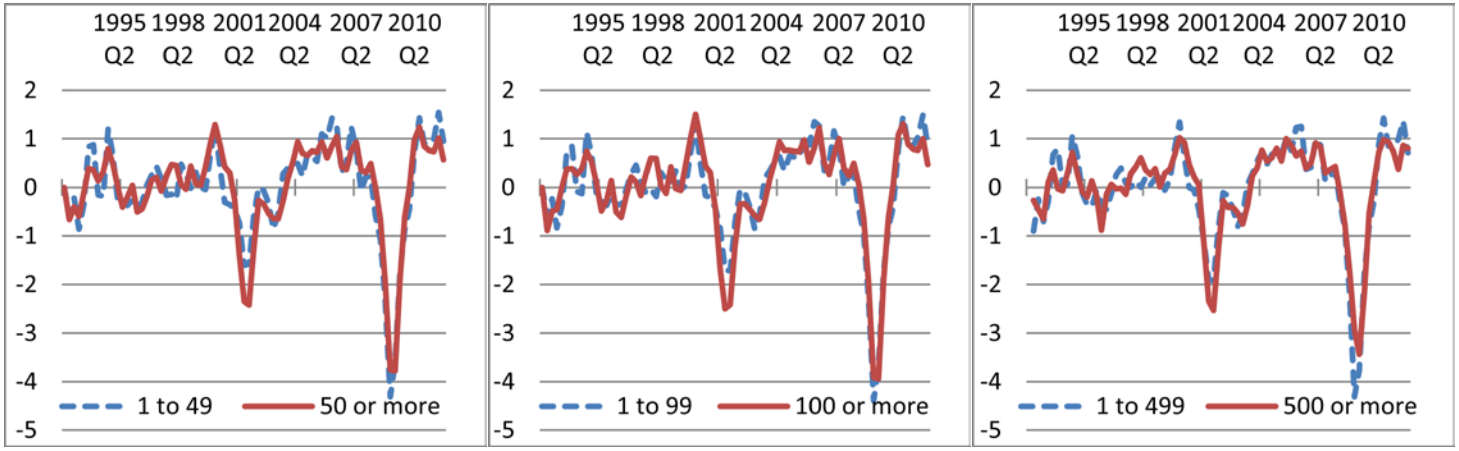


Figure 3.14 Net Job Creation and Net Job Creation Rates Between Small and Larger Firms, 1992 Q3 to 2011 Q4

Panel A in Figure 3.14 displays the "net job creation" measured as an employment level. In the first two definitions of small and large firms (the first two columns), the net job creation of larger firms is more volatile than that of small firms during 2001 recession and the 2007-2009 recession. Yet, in the third definition (the third column), the situation is reversed; the net job creation of small firms is more variable than that of large firms, particularly when we look at the 2007-2009 recession. This is partly because, I believe, when the net job creation is measured by the employment *level*, the fluctuations of small firms tend to change depending on how we classify small firms. For example, if small firms are defined to include *more* firm size classes, they are likely to show *more* net change in employment levels due to an increase in their population.

To address this issue, panel B in Figure 3.14 displays net job creation *rates*, rather than the employment level. Net job creation rates compare the contribution of job creation between small and large firms more accurately because they show a portion of the total number of jobs. As in Section 2, the growth rates of net job creation are reported hereafter I remove a trend from cumulative growth rates by using Hodric-Prescott (HP) filter. Notice that, when net job creation rates are used in panel B, the difference of the behavior between small and large firms is less dramatic than when the net job creation (levels) are used in panel A. During the 2001 recession, the net job creation rates of larger firms are somewhat more volatile than those of small firms in all three definitions of small and large firms. Yet, during the 2007-2009 recession, the net job creation rates of small firms are slightly more variable than those of larger firms in all three definitions. To examine the behavior of small and large firm between the 2001

and the 2007-2008 recessions more closely, the cumulative growth rates of net job creation are normalized by zero at the start date of the NBER recession, as in Section 2.

Figure 3.15 shows that, during the 2001 recession, the net job creation of large firms decreased substantially more than that of small firms in all three definitions (the left three columns). These results are consistent with the results produced from the SLOOS data set. Remember that senior loan officers report that, during the 2001 recession, they increased their loan standards and loan spreads to large and medium-size firms substantially more than to small firms (Figure 3.10 and 3.11) and that they also perceived large and medium-size firms increase their loan demand significantly more than small firms (Figure 3.12). On the other hand, during the 2007 to 2009 recession, the net job creation of small firms declines almost to the same extent as that of large firms (the first two columns in the right) or decrease slightly more than that of large firms (the bottom right column). These outcomes are also generally consistent with the outcomes produced from the SLOOS data. Recall that senior loan officers report that, during the 2007-2009 recession, they increased their loan standards and loan spreads to a very *similar* degree between small and large and medium-size firms or increased these two elements to large and medium-size firms slightly more than small firms (Figure 3.10 and 3.11), and that they see these two kinds of firms decrease their loan demand to almost the same extent (Figure 3.12).

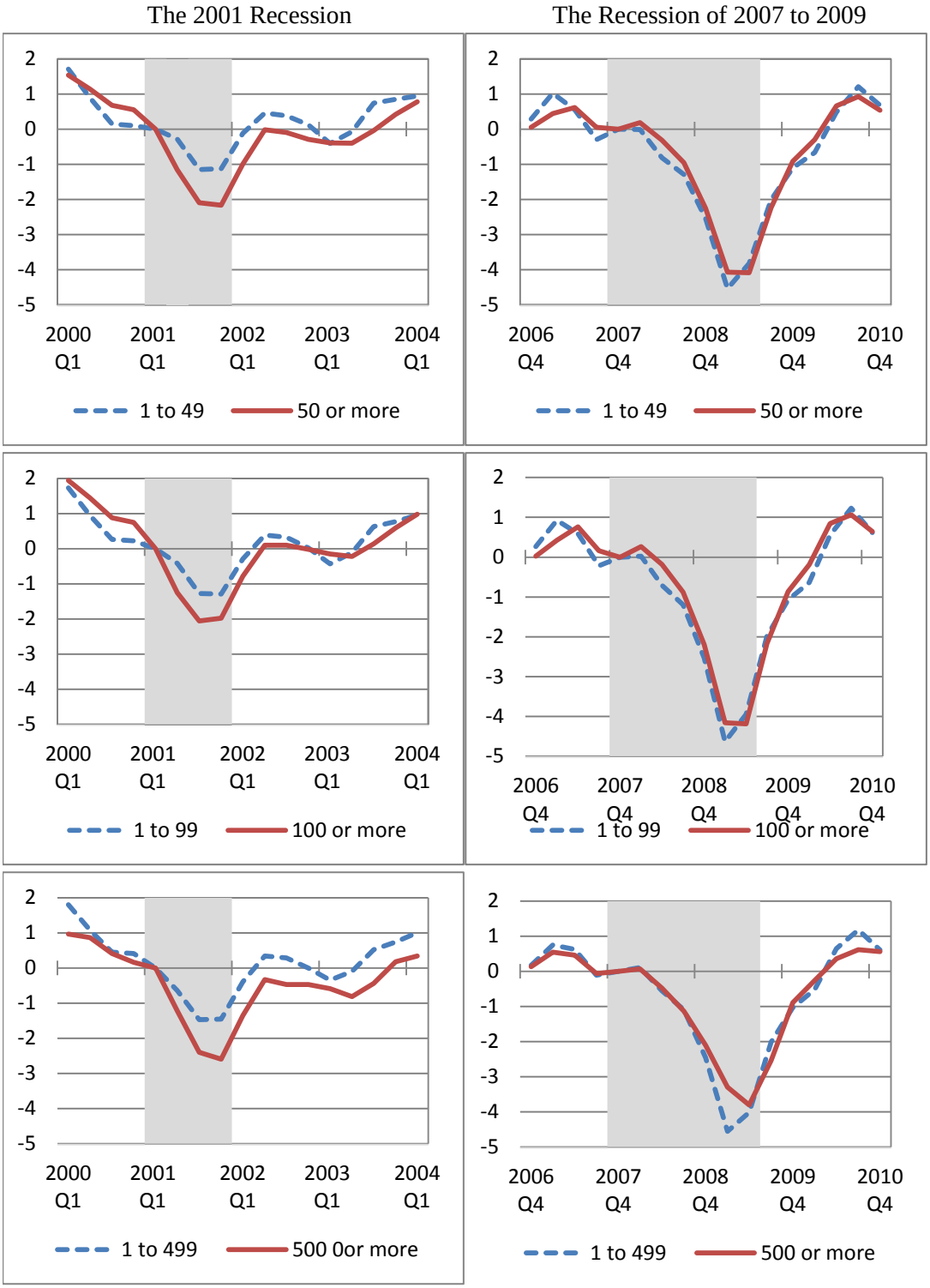


Figure 3.15 Cumulative Employment Changes Since the Start of the 2001 and 2007-2009 Recessions

3.4.2 The Responses of Small Versus Large Firms to Monetary Policy

3.4.2.1 The Flow of Funds Data and the QFR Data

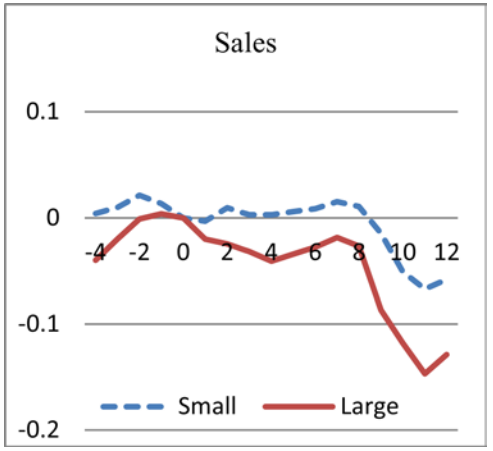
I examine the behavior of small and large firms during monetary policy episodes by using two different sources of data: the flow of funds data and the Quarterly Finance Report (QFR) data. In this analysis, two types of monetary policy shocks—"Romer dates" and "Adrian dates"—are used. As mentioned in Section 2, "Romer dates" are available only for earlier periods (pre-1990 periods) while "Adrian dates" are available for long historical sample periods (1960 Q1 – 2011 Q3). Although I have employed two types of monetary policy shocks, only the results produced by using "Adrian dates" are reported in this subsection. This is because "Adrian dates" allow us to make a comparison between earlier periods and recent periods. Nonetheless, the results produced by using "Romer dates" are also reported in Appendix C.

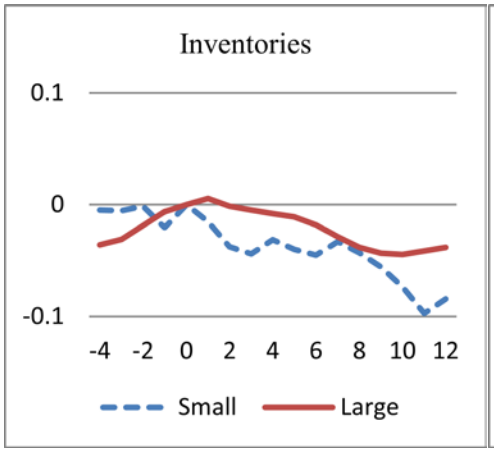
Employing the flow of funds data and the QFR data, Figure 3.16 shows the average changes in some balance sheet variables (sales, inventories, trade debt and total short-term debt) and in components of aggregate debt (bank debt, mortgages, commercial papers, and other debt) after a tight monetary policy shock. I also report only the *average* behavior of small and large firms after a tight monetary shock. Employing the flow of funds data, the first two columns show the average behavior of small and large firms during earlier periods (pre-1990 periods) and recent periods (post-1990 periods). Employing the QFR data, the third column shows the average behavior of small and large firms during recent periods (post-1990 periods). In addition, I report partly the results of "sales," "short-term bank debt," and "mortgages" for either the flow of funds data or the QFR data because these variables are available only for one of the two data

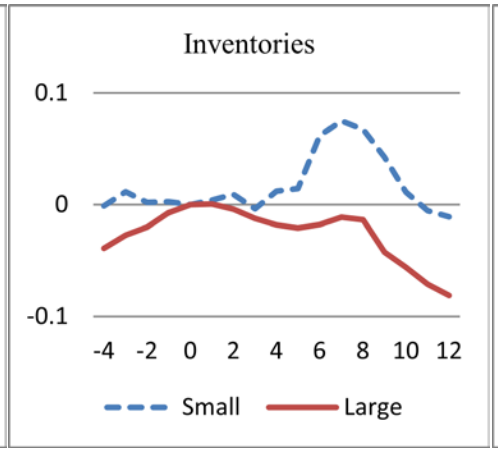
Flow of Funds Data
(Earlier periods: 1960Q1−1989Q4)

Flow of Funds Data
(Recent Periods: 1990Q1−2011Q3)

QFR Data
(Recent Periods: 1990Q1−2011Q3)







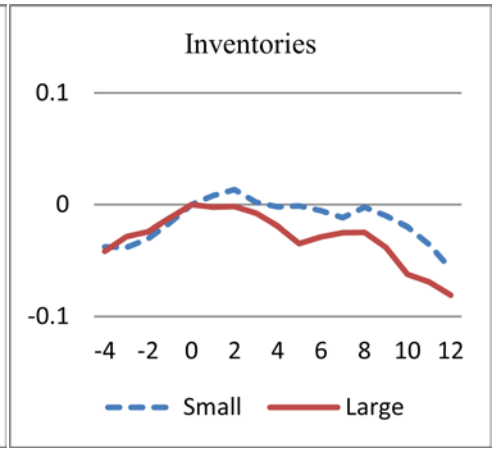


Figure 3.16 Average Changes in Sales and Some Balance Sheet Variables After a Monetary Policy Shock (Adrian Date)

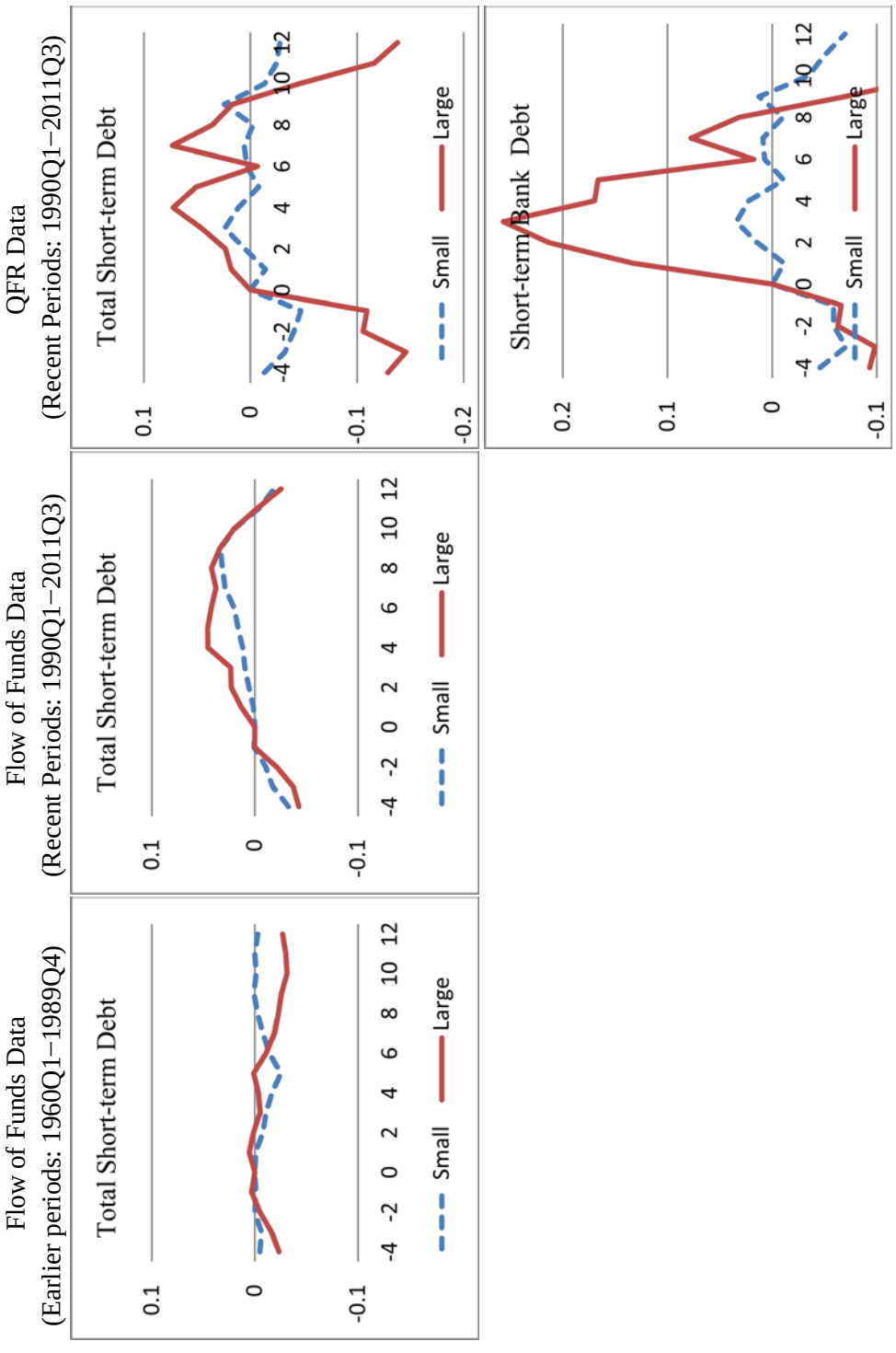


Figure 3.16 Continued

Flow of Funds Data
(Earlier periods: 1960Q1−1989Q4)

Flow of Funds Data
(Recent Periods: 1990Q1−2011Q3)

QFR Data
(Recent Periods: 1990Q1−2011Q3)

Figure 3.16 Continued

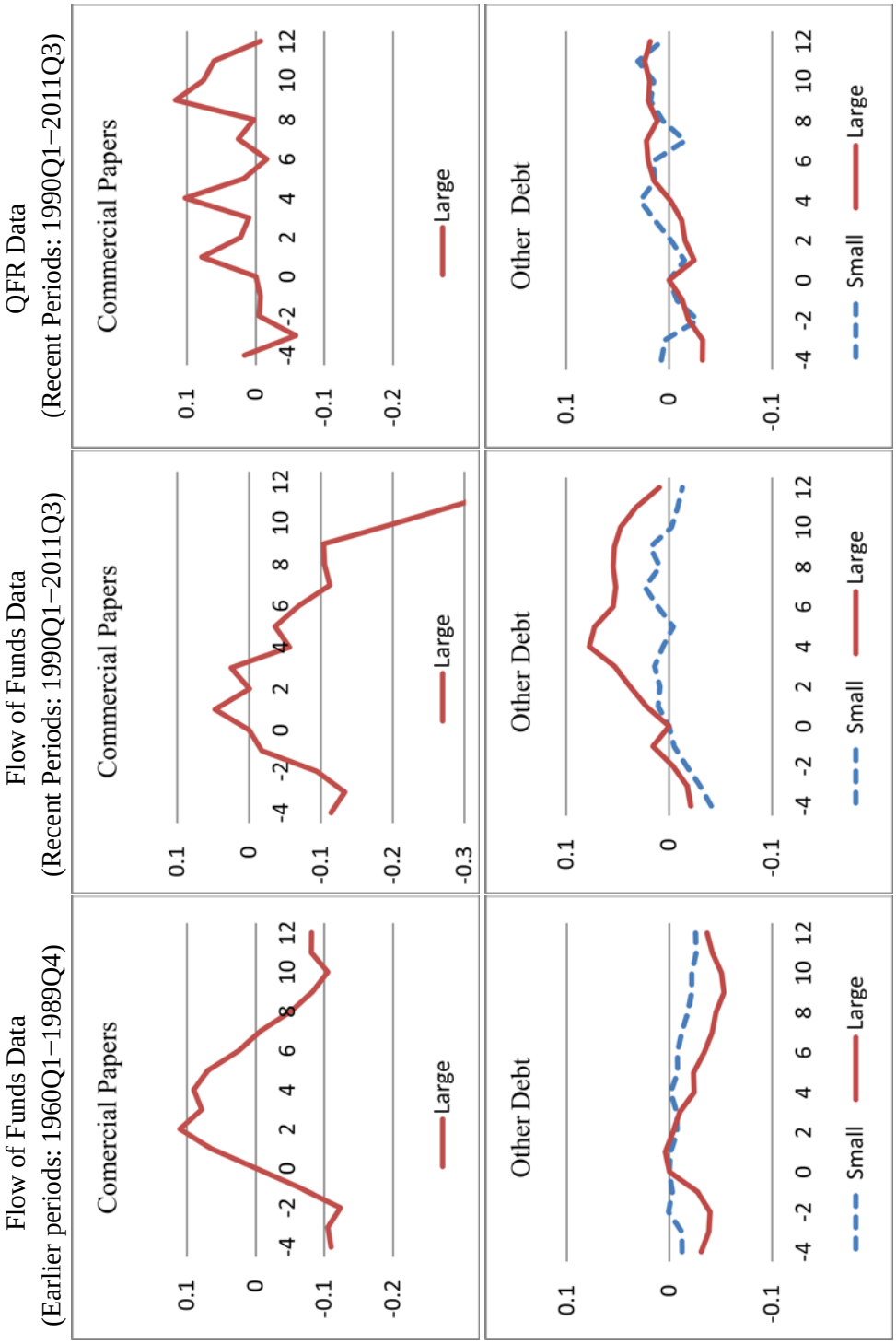


Figure 3.16 Continued

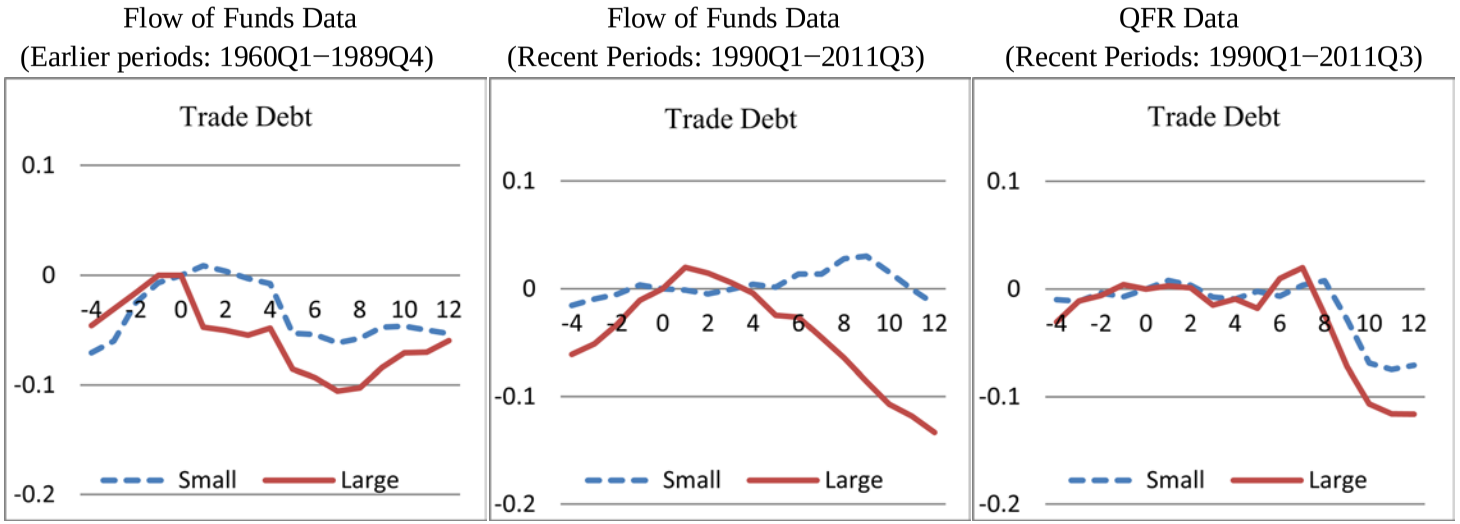


Figure 3.16 Continued

sets.

During recent periods in the QFR data (the third column), the sales of small firms hover around zero up to 8 quarters after a monetary policy shock and afterward start to decline; the sales of large firms begin to decline slightly after a monetary policy shock and then recover until 8 quarters have passed. Finally, they decline sharply. In particular, the sales of small and large firms in Figure 3.16 exhibit a very similar pattern to the sales of small and large firms in Figure 3.9, which are produced after an NBER recession shock. Just as large firms decrease sales substantially more than small firms after an NBER recession shock, their sales decrease significantly more than small firms after a monetary policy shock. However, a monetary policy shock has a weaker impact on the sales of small and larger firms than an NBER recession shock. During earlier periods in the flow of funds data (the first column), the inventories of small firms drop slightly more than those of large firms. Yet, during recent periods in the flow of funds and the QFR data (second and third columns), this pattern tends to change; large firms decrease their inventories more than small firms.

During earlier periods in the flow of funds data (the first column), the total short-term debt of small and large firms behaves similarly after a monetary policy shock, showing virtually flat-shaped responses. Yet, during recent periods in the flow of funds and the QFR data (the second and third column), both small and large firms tend to *increase* their total short-term debt after a monetary policy shock. The total short-term debt of small and large firms shows a *rising-and-falling* pattern (an inverse U shape) during periods of tight monetary policy. This result is consistent with the results

produced from past research.[27] In particular, recent periods of those two data sets reveal that, after a monetary policy shock, large firms increase their total short-term debt somewhat more than small firms. Such behavior of large firms is more pronounced in the QFR data than in the flow of funds data.

The components of aggregate debt do not show a consistent pattern after a monetary policy shock. During recent periods, bank debt and other debt of small and large firms display a rising-and-falling pattern in the flow of fund data (the second column), but they show an ambiguous behavior in the QFR data (the third column). Similarly, it is very difficult to find a consistent pattern in the other components of aggregate debt.

During earlier periods in the flow of funds data (the first column), the trade debt of large firms tends to decrease slightly more than that of small firms. During recent periods in the flow of funds data (the second column), large firms decrease their trade debt immediately after a monetary policy shock, but small firms are initially unaffected and start to increase slightly after 5 quarters. During recent periods in the QFR data (the

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[27] Employing the QFR data, Gertler and Gilchrist (1994) find that after tightening monetary policy, the behavior of total short-term debt mirrors the behavior of inventories for small and large firms. Following tight monetary policy, large firms tend to *increase* both inventories and total short-term debt, whereas small firms tend to *decrease* both inventories and total short-term debt. Gertler and Gilchrist interpreted these results as support for the notion that large firms may borrow total short-term debt more than small firms to smooth the impact of a recession—at the time that the need for external finances rises to carry inventory accumulations. Gertler and Gilchrist's interpretation works well during earlier periods. In other words, the inventories and bank debt of large firms increase more than those of small firms during earlier periods in the flow of funds data (the first column).

Although Gertler and Gilchrist's interpretation works well in the earlier-period flow of funds data, it does not fit into the recent-period flow of funds and QFR data. During recent periods, I find that the short-term debt of large firms increases more than that of small firms, consistent with Gertler and Gilchrist' (1994) findings. However, the inventories of large firms tend to *decrease*, not increase, whereas the inventories of small firms sharply increase or are unaffected for some periods. The question is "Why do large firms still increase total short-term debt in spite of a decrease in their inventories?" One possible explanation is that, since large firms experience the decline in sales (the first row) and thus a decline in cash flow, they may still need to borrow more short-term debt to finance operating costs rather than inventory costs.

third column), small and large firms show a similar response; they hover around zero until 6 quarters and afterward begin to decline.

The main finding is that, during recent periods, the total short-term debt of small and large firms tends to increase after a monetary policy shock. In particular, large firms increase their total short-term debt more than small firms. Such behavior of large firms is shown more clearly in the short-term bank debt of the QFR data. Moreover, during recent periods, some balance sheet variables and components of debt of larger firms generally show more sensitive behavior than those of small firms following a monetary policy shock.

When the NBER recession episodes (in Figure 3.9) are compared to the tight monetary episodes (in Figure 3.16), an NBER recession shock shows a substantially stronger impact on the behavior of firms than a monetary policy shock. During the NBER recession episodes, the behavior of firms is usually captured in the vertical axis that ranges from 1 to –2. During tight monetary episodes, the behavior of firms is typically captured in the vertical axis that ranges from 1 to –1. In addition, during recent periods, when the flow of funds data are compared to the QFR data for the total short-term debt and (short-term) bank debt, large firms show much more sensitive behavior than small firms, as shown in Figure 3.9 and 3.16.

3.4.3 Is a Monetary Policy Shock Different from an NBER Recession Shock?

Figure 3.17 and 3.18—which are extracted from Figure 3.9 and Figure 3.16, respectively—show the average changes in “total short-term debt” and “short-term bank debt” after either an NBER recession shock or a monetary policy shock. The

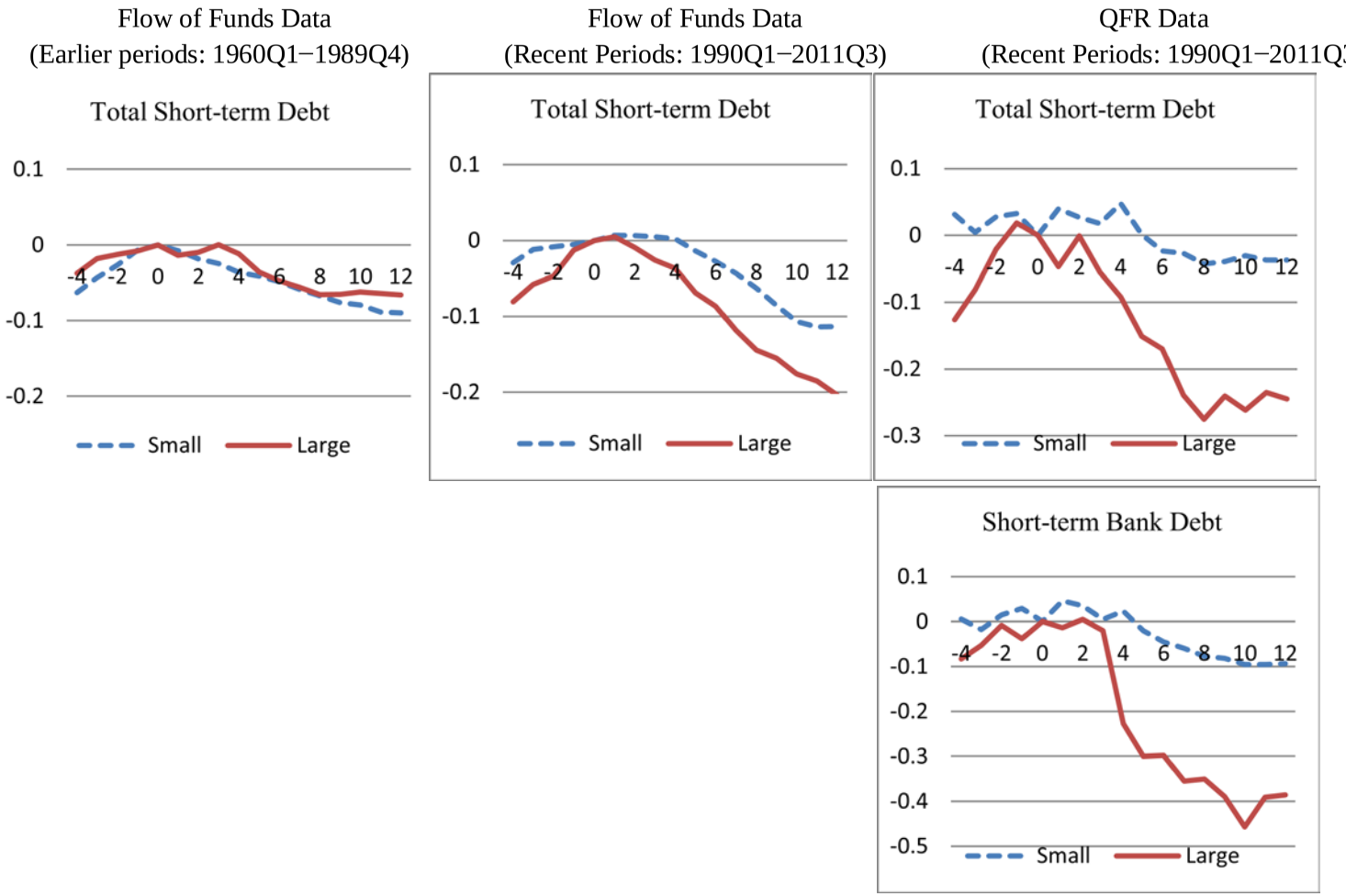

Figure 3.17 Average Changes in Total Short-term Debt and Short-term Bank Debt Around Beginning Dates of NBER Recessions

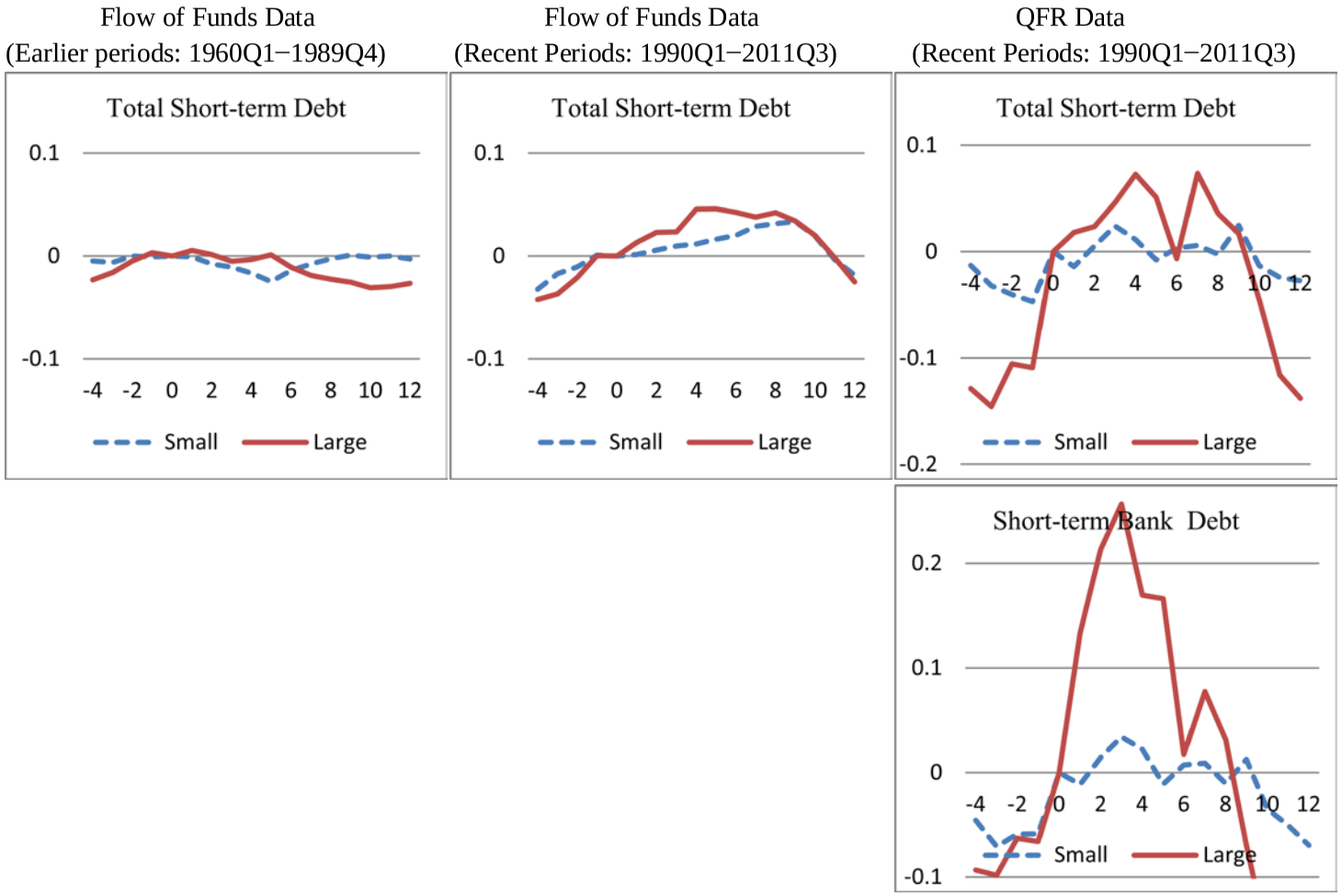

Figure 3.18 Average Changes in Total Short-term Debt and Short-term Bank Debt Around Monetary Policy Shock (Adrian Dates)

comparison of these results suggests that a monetary policy shock is somewhat different from an NBER recession shock in that it affects a short-term financing pattern of firms *differently* in recent periods. As shown in Figure 3.17 and 3.18, in recent periods (the second and the third column), both small and large firms tend to *decrease* total short-term debt and short-term bank debt after an NBER recession shock, while they tend to *increase* these debts after a monetary policy shock.[28] In particular, it is important to notice that large firms show much more sensitive behavior than small firms—after either an NBER recession shock or a monetary policy shock. Large firms decrease short-term bank debt substantially more than small firms after an NBER recession shock; likewise, they increase short-term bank debt significantly more than small firms after a monetary policy shock.

More specifically, by comparing the behavior of "the QFR data" to the behavior of the "Flow of Funds data" (the second versus the third column), we can observe that the excess sensitivity of large firms is more pronounced in the QFR data than in the flow of funds data—after either an NBER recession shock or a monetary policy shock. Furthermore, examining only the QFR (the third column) allows us to compare the behavior of "*total* short-term debt" and the behavior of "short-term *bank* debt" after each kind of shock—i.e., the comparison of the first and the second row in the third column. It is interesting to note that such excess sensitivity of large firms is *even more* pronounced in short-term bank debt than in total short-term debt. That is, after an NBER recession shock, a comparison between the total short-term debt and the short-term bank debt (in the third column of Figure 3.17) shows that, for large firms, the

[28] In the earlier periods, on the other hand, either small or large firms are practically unaffected or slightly decline total short-term debt and short-term bank debt after the two kinds of shocks.

trough of short-term *bank* debt is two times as deep as the trough of total short-term debt: −0.45 in short-term bank debt and −0.27 in total short-term debt. On the other hand, after a monetary policy shock, a comparison between total short-term debt and short-term bank debt (in the third column of Figure 3.18) shows that, for large firms, the peak of short term bank debt is four times as tall as the peak of total short-term debt: 0.27 for short-term bank debt and 0.07 for total short-term debt. From these empirical results, several critical questions arise:

- Why do small and large firms tend to *decrease* total short-term debt and short-term bank debt after an NBER recession shock?
- Why do small and large firms tend to *increase* total short-term debt and short-term bank debt after a monetary policy shock?
- Furthermore, why do large firms show more sensitive responses (than small firms) to either an NBER recession shock or a monetary policy shock in recent periods?

This research paper provides some responses to these three questions. The first and second questions will be answered by examining the *aggregate behavior* of small and large firms.[29] The third question will be answered by accounting for the *disaggregate behavior* of firms. For the first and second questions, a plausible explanation will be illustrated in this section. For the third question, a more detailed explanation will be further illustrated in the subsequent section.

For these first two questions, the use and the availability of "bank lines of credit," which has been more commonly used in recent years, provides one possible explanation

[29] In this case, the explanation focuses on the aggregate behavior of firms because both kinds of firms respond in the *same* direction to either a monetary policy shock or an NBER recession shock.

for the responses of firms' short-term financing to be different between a monetary policy shock and an NBER recession shock. Because lines of credit can be used as a source of liquidity to some borrowers in times of financial difficulties, a different short-term financing pattern of borrowers may reflect the different ability of borrowers to draw down their credit lines. The borrowers' ability to draw down their lines, in turn, depends on the financial conditions of borrowers *at a time* when either an NBER recession shock or a monetary policy shock arises.

The basic idea suggested in this paper is that, after an NBER recession shock, if borrowers experience a *severe* deterioration of their financial conditions (over a downturn), they may not be able to draw on their credit lines; such limitation of credit lines may generate a *decreasing* pattern of short-term finances. However, after a monetary policy shock, if borrowers undergo a somewhat *weak* exacerbation of their financial conditions (over an upturn) and still maintain strong financial condition,[30] they may be able to draw down their credit lines; such drawdown of credit lines may create an *increasing* pattern of short-term finance. More detailed explanations concerning this basic idea will be demonstrated in the following subsections.

3.4.3.1 Lines of Credit

In credit line contracts, lenders promise that they will lend up to a certain amount of money within a certain period of time at a predetermined variable rate, the overall interest rate on credit lines. It is known that the predetermined rate consists mainly of a *borrower-specific risk premium*—usually called a fixed markup—and a floating *market*

[30] Tight monetary policy is likely to arise when the economy is strong over an upturn of the business cycle.

interest rate, such as a prime rate and LIBOR (Melnik & Plaut, 1986; Shockley & Thakor, 1997). For example, suppose that a lender allows a borrower to take down its balances at a 1% fixed markup (i.e., a risk premium) over a floating prime rate (i.e., a market rate)—i.e., prime plus 1%. In this contract, although the overall interest rate on the credit line is variable over time, it is important to note that a borrower-specific risk premium is fixed during a period of the contract. Such a fixed risk premium shelters borrowers from increases in interest rates, which might be triggered either by the deterioration of a borrower's credit quality or by an increase in spread in market-wide risk. In particular, say a borrower is locked into a fixed borrower-specific risk premium in credit lines (e.g., prime plus 1%), and a lender is obligated to lend someday at that rate. In this situation, let's consider what happens if the borrower's own spot market risk premium increases (e.g., prime plus 2%) due to the financial crisis of 2008, for example. Typical borrowers, in such a situation, would be expected to draw down their credit line if they needed some external finance, because the interest rate on their credit line is lower than what would be available in the spot credit market.

Although lines of credit are the prearranged loans settled between lenders and borrowers, credit-line contracts usually contain "financial covenants" and "contingency clauses" that limit the ability of borrowers to draw down their lines. In financial covenants, borrowing under lines of credit is required to maintain financial ratios, such as cash flow, coverage, liquidity, and other covenants that are all specified in the initial credit contracts (Sufi, 2009). The violations of financial covenants allow lenders to withhold the prearranged credit lines from borrowers or to renegotiate the credit lines on stricter loan terms. In addition to financial covenants, most credit lines usually

contain a Material Adverse Change (MAC) clause, even if they are infrequently invoked. If the credit quality of borrowers deteriorates significantly for some reason, such contingent clause allows lenders to restrict an amount of borrowing under lines of credit (Shockley & Thakor, 1997).

3.4.3.2 A Monetary Shock and the Availability of Credit Lines

As discussed above, the ability of borrowers to draw down their lines is conditional on the obedience of financial covenants and contingency clauses, which in turn are directly linked into the financial conditions of borrowers. As a result, it is reasonable to claim that the use and the availability of credit lines will be determined by the borrowers' financial conditions. Most importantly, the financial conditions of the borrowers may differ (1) *at a time* when an NBER recession shock occurs and (2) *at a time* when a monetary policy shock occurs.

The financial conditions of borrowers are likely to be *somewhat strong* at a time when a monetary policy shock arises. This is because borrowers may be able to create enough cash flow from their operations in order to cover debt services during the late expansion—especially at the *somewhat early stage* of the late expansion, as shown in Figure 3.19.[31, 32] More specifically, in the expansion phase of the business cycle, a positive productivity shock to the economy propagates the business cycle when it has

[31] According to Sinai (1978), the financial cycle can be categorized into phases analogous to the business cycle of Recovery, Peak, Slump or Recession, and Trough. The financial cycle has showed stages termed Accumulation, developing financial instability or the Precrunch period, Crunch, and Reliqefication. The stage of the financial cycle and the business cycle resemble each other as follows: Recovery (Reliqefication and Accumulation), Boom (Accumulation and Precrunch period), Peak (Crunch), and Recession (Reliqefication), trough (Reliqefication).

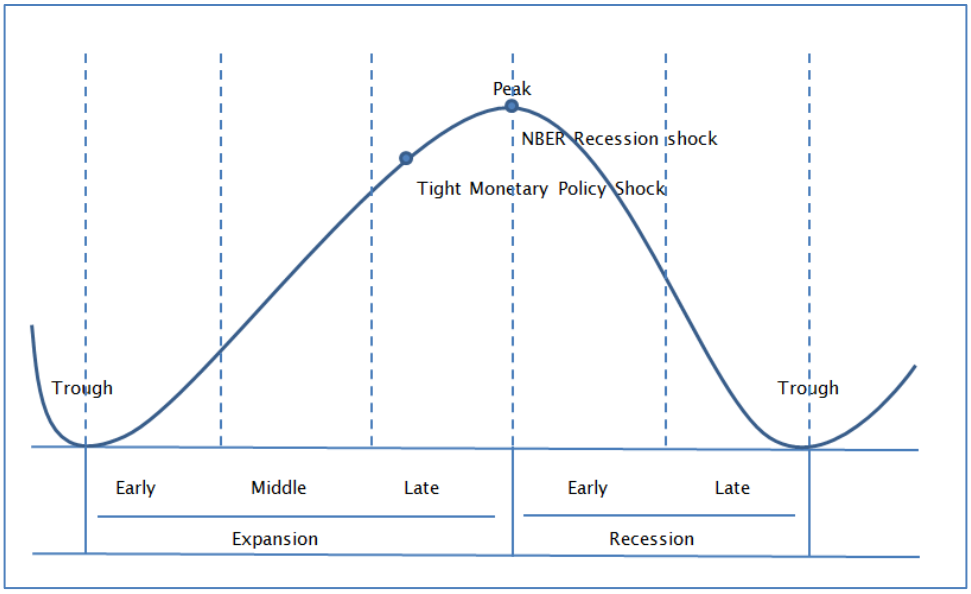

Figure 3.19 Timing of a Monetary Policy Shock and an NBER Recession Shock

been amplified by the continuous improvement of the borrowers' financial conditions. According to Bernanke and Gertler (1989), an increase in productivity (i.e., a small shock) enhances the cash flow and balance sheet positions of borrowers in current periods. In turn, an improvement of borrowers' financial positions can contribute to a lower cost of external finances in subsequent periods. Such lower cost in the following periods extends the expansions, as borrowers are motivated to invest continuously (even after an initial productivity shock has disappeared).[33] The underlying idea that a small shock can be amplified by influencing the credit-market conditions is called the "financial accelerator" theory. This theory can be applied to *any* positive shock that

[32] In Sinai's nomenclature, the "Precrunch period" in the financial cycle—an ongoing tight monetary policy falls into this Precrunch period—occurs between "Recovery" and "Peak" in the real business cycle, more specifically at the "late expansion" and "boom."

[33] An increase in productivity is likely to be accomplished by events "such as new inventions, new industries, development of new sources, and opening of new land or new market" (Fisher, 1933, p. 348). Fisher (1933) suggests that such events may create new investment opportunities for a greater prospective profit (in addition to an increase in productivity), so that they play an important role as *a starter* of the over-indebtedness in his debt-deflation theory.

improves borrowers' cash flows or balance sheet conditions. In particular, the financial accelerator theory helps to explain how borrowers' financial conditions (initiated by such a positive shock) become stronger and healthier as the business cycle expands—especially through the feedback effects on financial conditions, the cost of external finance, and investment spending. It is likely that borrowers face a virtuous circle of improving financial conditions, falling costs of external finance, and rising investment spending in the *early and middle* expansion, as shown in Figure 3.19.[34]

However, as the economy becomes overheated during the *late* expansion, demand for credits may outstrip the ability of lenders to supply credit at moderate rates; what is more, demand for credit may further increase with accelerating inflation (Eckstein & Sinai, 1986). Accordingly, when the liquidity squeeze takes place, borrowers may find that external finances become less obtainable and available but at higher rates. Although interest rates rise continuously during the late expansion, these rising rates may not fully discourage demand for credit. During the upturn of the business cycle, firms may still expect continuous future profits because of a strong aggregate demand, or they may need more credits because of accelerating inflation. At some point in time, the Fed is likely to adopt a restrictive monetary policy when it has been highly disturbed by noticeable signs of a boom—particularly when the Fed identifies the economy to grow substantially beyond its trend and such economic growth may extraordinarily push up inflation. Because an important objective of monetary policy is to maintain price stability, the Fed may decide to slow down accelerating inflation by raising interest rates. This response is most likely to happen at the *somewhat early stage* of the late

[34] At the same time, the optimism and overconfidence of borrowers about good business prospects may increase investment spending or production, boosting the aggregate demand.

expansion, as shown in Figure 3.19, when the financial conditions of borrowers are still *robust* to some extent.

Although a restrictive monetary policy affects borrowers' financial conditions unfavorably to some degree, most borrowers, who may still maintain strong financial conditions, are likely to remain compliant with financial covenants and contingency clauses. Such compliance of financial contracts allows borrowers to draw down their credit lines when loan demands increase. More specifically, suppose that the Fed decides to sharply increase the interest rate. After tightening monetary policy, when the borrowers' financial positions become deteriorated *to some extent*, borrowers may observe that their risk premiums in spot markets increase sharply, but their prearranged risk premiums in credit lines do not change. In other words, they know that their risk premiums in spot markets would be higher than their prearranged risk premiums in credit lines. In this situation, borrowers are likely to make use of their credit lines after a tight monetary policy because their credit lines are available on more pleasing terms than spot market loans. [35]

3.4.3.3 An NBER Recession Shock and the Availability of Credit Lines

The financial conditions of borrowers are likely to be *vulnerable* at a time when an NBER recession shock arises. This is because borrowers may not be able to create enough cash flow from their operations to cover full-blown debt services in the late expansion—especially at the *very* end of the late expansion, the peak of the business

[35] Particularly, it is important to note that after tightening monetary policy, although borrowers' net cash flows from their operations become decreased, their cash flow receipts from operations may still exceed their cash flow payments due to debts.

cycle, as shown in Figure 3.19.[36] More specifically, during the early and middle expansion, continuing enhancement in borrowers' financial conditions may allow borrowers to build their indebtedness constantly; during the late expansion, the continually rising demand for credit (as a result of accelerating inflation during a boom) increases the intensity of borrowers' indebtedness more severely.[37] In the situation where debtors become intensely indebted, at some point in time, the Fed (identifying the economy as overheated) may start to raise interest rates. A *continuous and gradually* tighter monetary policy is likely to exacerbate borrowers' financial conditions *more and more* to some extent, reducing borrowers' net cash flow. In particular, as interest rates sharply rise over time, the financial conditions of borrowers—which were somewhat robust at a time when tight monetary policy began—become increasingly weakened. At the same time, the cash flow payments due to swelling debts may catch up with the cash flow receipts from their operations. As borrowers' net cash flows become reduced, more debtors are continuously forced to issue new debts or to sell their financial assets to raise funds that should be used to pay off their maturing debts—i.e., refinancing their positions. In this situation, it is important to notice that, because some borrowers can still increase their indebtedness by drawing down their credit lines even after an ongoing tight monetary policy, their financial positions become increasingly more strained than others' financial positions. Consequently, as the volume of indebtedness increases and net cash flow decreases rapidly at the very end of the late expansion, the financial conditions of borrowers may become extremely vulnerable to *small*

[36] In the nomenclature of Sinai (1978), "Crunch" in the financial cycle corresponds to the "Peak" and "very early stage of downturn" in the real business cycle.

[37] Simultaneously, interest rates may start to rise naturally in the late expansion before the Fed's action of a tight monetary policy, as the liquidity dries up by the overheating of the economy.

disruptions in the economy.

As suggested by Eckstein and Sinai (1986) and Bernanke et al. (1996), borrowers tend to be financially overreached and hence "vulnerable" at the cyclical peaks. When the business cycle approaches the upper turning point, borrowers are likely to be very susceptible to the disruptions of either financial or real markets—i.e., at the cyclical peaks.[38] Such disruptions to the economy may come from either "external shocks" or "endogenous developments" in the business cycle. For example, external shocks are a variety of events, such as the swing to a federal budget in 1960, the auto strike of 1970, the oil price hike of 1973-74, the collapse of the dot-com bubble in 2001, the collapse of the housing bubble in 2008, etc. Endogenous developments arise when debtors cannot refinance their maturing debts at some point (because of lenders' concerns about borrowers' over-indebtedness) or when an economic expansion naturally ends in the process of a business cycle.

When the financial structure becomes enormously fragile at the very late stage of the expansion, a *small* disruption of the market (i.e., an NBER recession shock) may lead to a severe recession in conjunction with the outbreaks of other ensuing full-grown events—such as collapses of financial institutions or widely increasing defaults and failures of businesses, sharply falling asset prices, severe cutbacks in spending (due to increasing pessimism), increasingly prevalent credit rationing, and an inapt continuous monetary tightening.[39, 40] Such multiple and simultaneous, or a series of, bad events are

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[38] When borrowers' over-indebtedness has substantially increased at the very late stage of the expansion (close to a cyclical peak), lenders of credit may have full-blown pessimism and skepticism about borrowers' "solvency" or "creditworthiness," and thereby may stand ready to withdraw their credits supplied in the event of disruptions.

likely to deteriorate borrowers' financial conditions *to a large extent*, reducing borrowers' net cash flow substantially.[41] At this moment, the cash flow outlays from debts may exceed the cash flow receipts from operations by a significant amount. At the onset of a recession, therefore, as many borrowers' net cash flow suddenly changes from a positive to negative number, borrowers may not be able to issue new debt—by using credit lines or other financial methods—at a time when the need for new debt is most acute. At this time, borrowers may not be able to draw down their credit lines because they may violate financial covenants and contingent clauses due to their weaker financial conditions. Likewise, in other financial instruments, borrowers may not be able to renew their existing loans, such as commercial papers or bank loans, with the same reason.

3.4.3.4 Summary

To sum up, a monetary shock may deteriorate borrowers' financial conditions *to a lesser extent*, reducing their cash flow slightly, when an economy experiences the upturn of the business cycle. In this circumstance, because borrowers with somewhat strong financial conditions do not violate financial covenants and contingency clauses,

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[39] Credit crunches or financial crises have been considered and examined by Fisher (1933), Minsky (1975, 1977), Wojnilower (1980), Sinai (1976, 1978) and Eckstein and Sinai (1986). Fisher, Minsky, and Sinai consider such eruptions of events *endogenous* processes normally produced in the economy—a derivative of the real cycle that arises concurrently.

[40] Eckstein and Sinai (1986) introduce the business cycle with five stages that consider the coincident and interdependent behavior of real and financial markets: (1) recovery/expansion; (2) boom; (3) precrunch period/crunch; (4) recession/decline; and (5) reliquefication. They include a "credit crunch"—which is usually triggered by *a tight monetary policy* of a central bank—in the standard stages of the business cycle because every recession since the mid-1950s was preceded and caused by a credit crunch.

[41] Such multiple and simultaneous, or a series of, events may create a massive ripple effect throughout the entire economy, when changes in borrowers' financial conditions amplify and propagate the effects of initial real (or financial) disruptions—the "financial accelerator."

they may be able to draw down their lines. On the other hand, an NBER recession shock may exacerbate a firm's financial condition *to a great extent*, reducing its cash flow substantially, when the financial structure is extremely fragile at the cyclical peak (owing to borrowers' over-indebtedness). In this situation, because borrowers with very weak financial conditions violate financial covenants and contingency clauses, they may not able to draw down their lines. The next section will provide some plausible explanations for the third question described above.

3.5 Why Do Large Firms Show Much More Sensitive Behavior of Short-Term Debt in Response to an Adverse Shock?

In the previous section, the empirical results of post-1990 periods indicate that, after a monetary policy shock, large firms *increase* short-term debt substantially more than small firms; however, after an NBER recession shock, they *decrease* short-term debt significantly more than small firms. Such excessively sensitive behavior of large firms suggests that firms may have been affected by new or different economic forces during post-1990 periods. If so, what are the explanations for such findings? This section will discuss two possible explanations (of why large firms respond more sensitively to an adverse shock): (1) the financial conditions of borrowers, and (2) the benefits of lending relationships. I suggest that the former mainly justifies the excessively sensitive behavior of large firms in response to a monetary policy shock, whereas the latter mainly rationalizes such behavior of large firms in response to an NBER recession shock. However, the former can be applicable to the sensitive behavior of large firms in response to either a monetary policy shock or an NBER recession shock.

3.5.1 Financial Conditions of Borrowers

One possible explanation is related to the financial conditions of borrowers. The financial conditions of large firms may be different from those of small firms over the business cycle—especially at a time when a monetary policy shock or an NBER recession shock arises. In other words, large firms are likely to have *stronger* balance sheet conditions than small firms *at a time* when a monetary policy shock occurs; in contrast, they are likely to have *weaker* balance sheet conditions than small firms *at a time* when an NBER recession shock occurs. Such stronger or weaker financial conditions of large firms may play an important role in determining the availability of their short-term debts—either *after* a monetary policy shock or an NBER recession shock.

According to this explanation, the financial conditions of borrowers can be measured in terms of the collateralizable net worth of borrowers. Borrowers' collateralizable net worth includes net financial assets, tangible physical assets, and current and future expected cash flows that may be pledged as collateral (Gertler & Gilchrist, 1993). A number of researchers propose that borrowers' collateralizable net worth plays a critical role in lowering the cost of external finance (Bernanke & Gertler, 1989; Gertler & Gilchrist, 1993; Gertler & Hubbard, 1989). The greater the level of borrowers' collateralizable net worth, the smaller the potential conflict of interest with lenders. This is because borrowers can offer more collateral to lenders, making the expected cost of external finance low. In fact, it should be noted that firms' net worth tends to be procyclical, and the cost of external finance is inversely related to firms' net worth. During an expansion, where firms' net worth tends to rise, their rising net worth

decreases the cost of external finance, and it becomes easier to borrow. However, during a contraction, where firms' net worth tends to fall, their falling net worth increases the cost of external finance, and it becomes more difficult to borrow.

Furthermore, a number of empirical findings suggest that the financial conditions of large firms are *more* procyclical than those of small firms over the business cycle. Specifically, the sales and employment of large firms are more sensitive to the business cycle than those of small firms during recent periods of data set (see Chari et al., 2007; Kudlyak et al., 2010, for sales and see Moscarini & Postel-Vinay, 2008, 2009, 2012; Kliesen & Maués, 2011, for employment). These findings suggest that the net worth of large firms may swell during an expansion or shrink during a contraction at a faster rate than that of small firms.[42] For example, if large firms increase their employment and sales more than small firms over the course of an expansion, they may be able to generate more profits, thereby adding the profits to their net worth in subsequent periods. The opposite is true during a contraction. Therefore, over the course of an expansion, the net worth of large firms may *rise* at a faster rate than the net worth of small firms, making the financial conditions of large firms stronger. By contrast, over the course of a contraction, large firms' net worth may *fall* at a faster rate than small firms' net worth, making the financial conditions of large firms weaker.

Shifting from the financial conditions of firms over the business cycle to a moment of "shock," let's consider the short-term debt of small and large firms after a tight

[42] Using the QFR data, I have also examined the net worth and sales of small and large firm. Interestingly, the net worth and sales of large firms are more volatile than those of small firms, as shown the graphs in Appendix D. Unlike other available data sets such as Compustat, the flow of funds data, according to Gertler and Gilchrist (1994), the QFR includes a great deal of nontraded companies. "Nontraded firms dominate the lower tier of the size distribution in our sample. Thus, we believe that the vast majority of companies in our small firm sample would be considered likely to be constrained, using one of the conventional financial indicators" (p. 317).

monetary policy shock. At a time when a monetary policy shock arises, we would expect that, to the extent that net worth is more procyclical for large firms, the financial conditions of large firms are substantially stronger than those of small firms. In this situation, a sharp rise in an interest rate (as a result of a tight monetary policy shock) is likely to affect the financial conditions of small firms more adversely than those of large firms. This is so because a financial accelerator, which operates through the fluctuation of borrowers' net worth, is more applicable to *small* firms that have weaker financial conditions. [43] In particular, following a tight monetary policy shock, most small firms, which undergo the *severe* exacerbation of their financial conditions and do not maintain robust financial conditions, may be unable to make use of short-term debt from banks—especially bank lines of credit. In contrast, most large firms, which experience the *moderate* deterioration of their financial conditions and thus maintain still strong financial conditions, may be able to make use of short-term debt from banks and financial markets. More specifically, we should put an emphasis on the availability of credit lines after a monetary policy shock because credit lines are considered a major source of short-term finance.[44] After a monetary policy shock, most small firms may be unable to draw down their credit lines because they have violated cash flow-based financial covenants due to low cash flows.[45] Yet, after a monetary policy shock, most

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[43] In a financial accelerator effect, a monetary policy shock may worsen the financial conditions of small firms—those who have weaker financial conditions—*more strongly* than others. Therefore, since small firms (with lower net worth) must face a higher external finance premium, lower credit availability, and lesser investment, they contribute to the macroeconomic downturn *more significantly*.

[44] According to Melnik and Plaut (1986), credit lines (or loan commitments) account for 70% of commercial and industrial loans in the United States. The share of credit lines in commercial and industrial loans is likely to rise because credit lines have become more prevalently used in recent years.

large firms may be able to draw down their credit lines because they have complied with cash flow-based financial covenants due to still sustained cash flows.

As discussed earlier, the Fed is likely to adopt a restrictive monetary policy when an economy grows too rapidly. During such periods, the economy pushes beyond its trend, which causes inflation rates to increase to uncomfortable levels. At a particular point in time, a sustained and increasingly tighter monetary policy may reverse the relative financial conditions between small and large firms. Namely, the financial conditions of large firms—which were previously stronger than those of small firms at the time of a monetary policy shock—are now weaker than those of small firms at the time of an NBER recession shock. Why does this happen? Such a reversal of financial conditions may result from an environment of *continuously* and *gradually* rising interest rates. A sustained and gradually tighter monetary policy may influence a "burden of debt services" between two types of firms to a *different* degree. Because large firms are usually more highly indebted than small firms during an expansion, the burden of debt service is likely to be considerably greater for large firms over time.[46] For example, the lower cost of debt (resulting from the procyclicality of borrowers' net worth) may allow borrowers to build up a large amount of debt during an expansion. Such a buildup of debt may not be considered a serious problem to borrowers until a certain point is reached. As the Fed starts to increase interest rates continuously and gradually, such

[45] Also, many small firms cannot consider credit lines as a source of a short-term finance because they do not own the credit-line contracts with banks. Morgan (1990) finds that the share of loans made under credit lines tends to increase from about 33%, 56%, 70%, and 80%, as the size of loans increases—ranging from under $100,0000; $100,000 to $500,000; $500,000 to $1 million; and $l million to more. If small firms are correlated with the smaller size of loans, this evidence supports that small firms are less likely to own credit-line contracts with banks.

[46] According to the manufacturing firm data in QFR from 1987 Q4 to 2011 Q3, large firms' leverage ratio (2.6)—which is defined as the ratio of debt to equity—is higher than small firms' (2.2) on average.

large amounts of debt may serve to increase the burden of debt services, which is particularly a big concern to large firms.[47] Since the burden of debt services grows at a faster pace for large firms, this may make the financial conditions of large firms much more fragile over time—especially when a greater portion of cash flows or profits are used to service their existing debt.

Additionally, let's consider the short-term debt of small and large firms after an NBER recession shock. At a time when an NBER recession shock arises, we would expect that, to the extent that a burden of debt service swells more quickly for large firms after a continuing tighter policy, the financial conditions of large firms are more vulnerable than those of small firms. In this condition, an NBER recession shock is likely to affect the financial conditions of large firms more harmfully than those of small firms. This is so because the financial accelerator effect is more likely to operate through *large* firms that have more fragile financial conditions.[48, 49] In particular, following an NEBR recession shock, most large firms, which undergo substantially severe deterioration of financial conditions and do not have a close relationship with financial intermediaries, may be forced to cut back short-term debt from banks and the

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[47] As has been stated, *even* after a tight monetary policy shock, large firms (with still robust financial conditions) may continue to surge amounts of debts—either by utilizing their credit lines from banks or by issuing commercial papers from the financial markets. This may contribute to increase the burden of debt service more rapidly.

[48] Similarly, in a financial accelerator, an NBER recession shock may exacerbate the financial conditions of large firms that have weaker financial conditions—rather than small firms—more strongly. Here, the logic is the same as a monetary policy shock.

[49] Here, "financial factors" (credit constraint) explain the different behavior of small and large firms. However, "nonfinancial factors" can also explain the different behavior of the two kinds of firms after an NBER recession shock. One possibility is that large firms are concentrated on more greatly in cyclical industries. Another is that large firms may face lower demand for credit than small firms in some way—because large firms are related to more cyclical industries, for example.

financial markets *sharply*.[50] Notably, the sharply declining short-term debt of large firms may be closely associated with the characteristic of large firms that depend greatly on short-term debt (such as commercial papers) in the financial markets. Because borrowers' balance sheet conditions are readily available at any time to the public, lenders in the financial markets may be able to withdraw their short-term loans immediately—after they obtain bad news, for example. In any case, most small firms, which experience less severe exacerbation of financial conditions but do have a close relationship with financial intermediaries, may be compelled to diminish short-term debts from banks *to a lesser extent*. In regard to the availability of credit lines, both small and large firms may be unable to make use of credit lines after an NBER recession shock. This is because continuously and gradually increasing interest rates may change an overall financial structure from robust to fragile borrowing conditions, when it comes to the neighborhood of an upper turning point. Accordingly, both small and large firms that breach a cash flow-based financial covenant may not be able to draw down their lines.

3.5.2 Benefits of Lending Relationships

The other possible explanation—of why large firms respond more sensitively to an adverse shock to their short-term debts—is related to the benefits of lending relationships, close ties between firms and financial intermediaries. A number of empirical studies find that small firms with longer banking relationships are likely to have greater availability of credit, and pay a lower cost of credit, and are less likely to pledge collateral (see Petersen & Rajan, 1994, 1995, for the availability of credit and

[50] In the next section, the benefits of lending relationships will be discussed in more details.

see Berger & Udell, 1995, for the price of credit and collateral requirements). This evidence suggests that, during periods of tight credit, small firms with close ties to financial intermediaries are much more likely to obtain credit compared to large firms without such ties. During periods of financial difficulty, most small firms, which benefit from close relationships, may experience sluggish debt reduction, whereas most large firms, which do not derive benefit from relationships, may suffer from severe debt reduction.

On one hand, small firms may want to maintain a close relationship with financial intermediaries because maintaining a relationship is beneficial to them—especially in a situation when they cannot directly borrow from financial markets (due to the asymmetric information problems between borrowers and lenders). Lenders in public markets may be unwilling to provide credit to small firms because they have much more information about the prospects of their projects than lenders. Since small firms, in this way, pose severe asymmetric information problems in credit markets, financial intermediaries play an important role in overcoming information problems. In other words, financial intermediaries gather information about borrowers' ability to meet their financial obligations through a continuous interaction—for example, by way of monitoring borrowers and offering financial services to them.

Over the course of lending relationships, financial intermediaries may be able to develop their own expertise in understanding borrowers' financial needs and problems. By maintaining such relationships, as will be explained later, small firms may be able to build up "good reputation." The reputation may be used to help small firms smoothly enter public markets and obtain credits at lower interest rates. Furthermore,

encountering financial difficulty during periods of tight credit, small firms may have a greater likelihood that they can obtain new loans or renew their existing loans rather than be cut off from financial intermediaries. Most small firms, which do not have many alternative sources of funds and will hopefully be continuously financed in times of financial difficulty, are more cooperative at building up a relationship with financial intermediaries. For example, they are willing to pay for premiums or service fees of screening, monitoring, and financial services to intermediaries.

On the other hand, financial intermediaries may want to maintain a close relationship with small firms because such a relationship is beneficial to them as well. Financial intermediaries, according to Greenbaum, Kanatas, and Venezia (1989), Petersen and Rajan (1995), Rajan (1992), and Sharpe (1990), can benefit from monopoly power over years of lending because of the *private information*[51] they generate and because of the *search costs* borrowers incur. If the information that is produced by the relationships is durable and is not transferable to other lenders (private information), and if borrowers incur costs while searching for more favorable loan terms (search costs), financial intermediaries can exert monopoly power over the borrowers. According to this view, at an initial stage, monopolistic lenders charge

[51] Financial intermediaries may have an incentive to produce private information on small firms, which is called "soft" information. This private information is valuable to financial intermediaries because they can extract profits from such information in future transactions with small firms. In contrast, financial intermediaries may have little incentive to produce private information on large firms because this information is relatively less valuable to financial intermediaries due to the publicly available information about large firms. More specifically, there is very little likelihood that financial intermediaries will be able to extract profits from such private information in their transactions with large firms. Large firms, which generally borrow not only from financial intermediaries but also from the open markets directly, are obligated to disclose information about their management of firms (such as accounting information and credit ratings) to the public. This information is called "hard" information, and it is verifiable or is based on relatively objective criteria such as financial ratios, collateral ratios, and credit scores. Since financial intermediaries know that the "hard" information of large firms is always available at a low cost, they may have little incentive to produce costly private information (see Petersen, 2004; Berger & Udell, 2002, for soft information and hard information).

lower-than-competitive rates to lure clients and to establish a relationship while only incurring current short-term losses. However, at a later stage, they charge *higher*-than-competitive rates to recover the previous short-term losses and thus reap future monopolistic profits[52]—especially when some mechanism locks clients into the current relationship.[53] The relationship has been built on the belief that the short-term losses generated initially (by lenders) are offset by the expected profits extracted later over the life of lending.

This type of relationship is beneficial to monopolistic lenders for the following reasons. First, at the initial stage, monopolistic lenders have the chance to open up new relationships with small firms, while they are offering lower interest rates than competitive lenders would offer. These *lower* interest rates also may mitigate the adverse selection and the moral hazard problem of firms because *higher* interest rates are likely to drive away safer firms (the adverse selection problem) or persuade them to choose risky projects (the moral hazard problem). Second, at the later stage, monopolistic lenders can produce much higher profits when they charge higher-than-competitive rates. This is so because monopolistic lenders, who have accumulated private information through the relationships with borrowers, can reduce loan rates *by*

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[52] It is important to note that, although monopolistic lenders charge *higher*-than competitive rates, they may *reduce* interest rates over time. Monopolistic lenders reduce interest rates more *slowly* than lenders in competitive markets. Therefore, we would expect interest rates of monopolistic markets to fall more *slowly* than those of competitive markets.

[53] Such a "holdup" problem of a relationship occurs because the borrowers' search costs for finding other lenders, who have ability to handle their needs, are likely to be high—especially when the market has few lenders. This holdup problem does not last forever. In Greenbaum, Kanatas, and Venezia's (1989) model, the longevity of the relationship increases the likelihood that the borrower will switch to other lenders and consequently reduces the remaining expected length of the relationship. That is, they show that "the expected remaining duration of a lender-client relationship is decreasing in the existing length of the relationship. Thus, clients that have been with a particular lender longer will be more likely to leave and establish a relationship with another lender" (Greenbaum et al., 1989, p. 221).

less than the true decline in loan rates that competitive lenders would charge at the later stage.

Since maintaining a close relationship is beneficial to both small firms and financial intermediaries, as described in the previous two paragraphs, financial intermediaries are more willing to help small firms than large firms during recessions. For this reason, small firms may experience a more sluggish decrease of loans than large firms when the economy goes into recessions. In particular, financial intermediaries may want to lend a hand to small firms during recessions because of the *sunk costs* they have previously incurred and because of the *monopolistic profits* they will enjoy in the future.

First, financial intermediaries may have already incurred *sunk costs* to overcome asymmetric information problems, while committing a great deal of resources to understand the small firms' businesses. At the outset of the relationship, intermediaries have previously made payments for the high costs of screening and monitoring small firms. Over the long-term relationship, they develop the best knowledge of the ins and outs of firms' financial conditions through good and bad times. If they reject small firms during a recession, they know that they will lose the customers they have invested in up front. Second, as discussed earlier, since financial intermediaries have *monopoly power* over small firms (owing to their private information and the firms' search costs), they may think that, if they help small firms in times of financial difficulty today, they can extract monopoly profits tomorrow from the investment (Greenbaum et al., 1989; Petersen & Rajan, 1995; Rajan, 1992; Sharpe, 1990). For this reason, during periods of recessions, financial intermediaries are more willing to extend loans to small firms, allowing small firms to weather recessions with minimum losses. In contrast to what

happens to small firms, large firms may experience a more rapid decline of loans than small firms during recessions because of a *loose* relationship with financial intermediaries. If financial intermediaries overcome information problems and ease credit constraint during firms' financial difficulty, why do large firms choose to weaken a relationship with financial intermediaries? The answer should be that there are compensating benefits when large firms borrow directly from public markets or there are costs when they maintain the relationship with financial intermediaries. Switching from financial intermediaries to public markets, large firms may be able to sidestep two problems associated with financial intermediaries: the intermediaries' *monitoring costs* and their *monopoly power*.

First, large firms may want to avoid the monitoring costs of financial intermediaries. Small firms, which pose severe moral hazard problems, may be willing to pay the monitoring costs of financial intermediaries because intermediated loans are the only source of credit they can rely on in that financial intermediaries alone are well suited to deal with their moral hazard problems. However, large firms, which pose mild moral hazard problems, may feel the monitoring costs of financial intermediaries unnecessary— particularly when they can resort to an alternative source of credits in public markets.

Diamond (1991) suggests a "life cycle" of a firm's borrowing in the following way. A new firm that poses severe moral hazard problems may *initially* borrow from financial intermediaries because its moral hazard problem can be mitigated by the monitoring of financial intermediaries. Yet, the same firm that has obtained good reputation (i.e., reputation capital) through the monitoring of financial intermediaries

over time may *later* borrow directly from public markets because reputation alone can take care of moral hazard problems and consequently eliminate the need for monitoring.[54] According to Diamond (1991), during the life cycle of a firm' borrowing, large firms are likely to be the firms that may have accumulated "reputation capital" through a long-term relationship with financial intermediaries. Since such large firms have more reputation capital to lose when they take a risky action (i.e., less moral hazard problems), they may not need to incur the costs of monitoring associated with intermediated loans.[55]

Second, in addition to elusion from monitoring costs, large firms may also want to avoid the monopoly power of financial intermediaries. As discussed earlier, in a situation where financial intermediaries have the monopoly power, they may be able to extract big monopoly profits later by demanding higher interest rates than the competitive rates. To reduce such monopoly power, large firms may want to diversify their sources of funds. One way is that large firms borrow directly from public markets when they are large enough to bear the costs of issuing the public debt. By using public markets, they would acquire not only more discretion over investment decisions and production but also more bargaining power in negotiation with financial intermediaries. In any case, since maintaining a relationship with financial intermediaries would be costly for large firms owing to the intermediaries' monitoring costs and monopoly power, large firms may choose to weaken their relationship with financial

[54] That is, a firm's reputation capital obtained through intermediaries' monitoring will serve to predict the behavior of the firm in public markets in the absence of monitoring.

[55] By contrast, since small firms have not yet established enough reputation through intermediaries' monitoring, they have less "reputation capital" to lose when they take a risk action (i.e., severe moral hazard problem). Accordingly, small firms, who have a lack of access to public markets due to moral hazard problems, may need to incur the costs of monitoring to obtain loans from financial intermediaries.

intermediaries by borrowing directly from financial markets. When this relationship is loose, they may have more difficulty acquiring credits during periods of recessions and they experience more rapid reduction of loans than small firms.

3.5.3 Summary

This section provides why large firms show more sensitive behavior of short-term debt either after a monetary policy shock or after an NBER recession shock. The main theme is as follows. After a monetary policy shock, small firms may be more credit constrained than large firms because small firms undergo more severe exacerbation of *their balance sheet conditions* than large firms.[56] Small firms, who experience more *serious* deterioration of financial conditions, may be prohibited from drawing down banks' lines of credit—which become increasingly important as a source of liquidity. In contrast, large firms, who experience the *weak* exacerbation of financial conditions, may still be allowed to use their credit lines, expanding more short-term debt—at the time demand for loans increases. Therefore, the availability of credit lines explains why large firms increase short-term debt more than small firms following a monetary tightening.

On the other hand, after an NBER recession shock, large firms may be more credit constrained than small firms because they have more vulnerable financial conditions than small firms—*at a time* when NBER recession shock arises. Although large firms had stronger financial conditions than small firms at the time of a monetary shock, large

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[56] Some evidence suggests that the financial conditions of large firms are more procyclical than that of small firms (see Chari et al., 2007, for sales and see Moscarini & Postel-Vinay, 2008, 2009, 2012, for employment). If so, the financial conditions of large firms are stronger than those of small firms when tight monetary policy arises. Because a monetary tightening is likely to occur when the economy is strong, the loan demand for small and large firms may still increase when interest rates are rising.

firms may have *weaker* financial conditions at the time of an NBER recession shock. Because large firms tend to be more highly leveraged than small firms during an expansion, a sustained and increasingly tighter monetary policy may deteriorate the financial conditions of large firms more rapidly than that of small firms. For this reason, after an NBER recession shock, most large firms, who undergo more severe deterioration of financial conditions, find it hard to obtain credit more than small firms. In addition to their weaker financial conditions, large firms may face more difficulty in obtaining credit because they have looser relationships with intermediaries than small firms. After an NBER recession shock, small firms with a close tie with financial intermediaries may benefit from the relationship lending at the time of financial difficulty, whereas large firms without such close ties may suffer from the decline of loans more harshly. Therefore, the borrowers' financial conditions and lending relationship with lenders help us understand why large firms decrease short-term debt more than small firms.

3.6 Conclusion

Previous research, particularly the credit channel of monetary policy, finds that small firms are more credit-constrained than large firms after a *tight monetary shock*. Small firms, according to this channel, play a special role in the monetary transmission mechanism. Recently, however, a large number of researchers find that large firms are more sensitive to a *business cycle shock* than small firms in terms of sales, inventories, short-term debt, and employment. Why does the recent research find somewhat different results from the previous ones? Do large firms, rather than small firms, play a unique role after business cycle shock—particularly in recent periods? To address these

issues, I examine the behavior of small and large firms in two ways: (1) by different episodes, a monetary policy shock and an NBER recession shock and (2) by different periods, earlier periods and recent periods.

First, by examining the behavior of small and larger firms by different episodes, I find that a monetary policy and an NBER recession shock *differently* affect firms' short-term financing behavior. During recent periods, while firms *increase* their short-term debt after a tight monetary policy shock, they *decrease* after an NBER recession shock. What is more, large firms exhibit much more sensitive behavior in their short-term debt than small firms to the two kinds of shocks. That is, after a contractionary monetary policy shock, large firms increase their short-term debt more than small firms; however, after an NBER recession shock, large firms decrease more than small firms.

These findings suggest that small firms are likely to be more credit-constrained after a monetary policy shock, whereas large firms are likely to be more credit-constrained after an NBER recession shock. If so, as in the balance sheet channel theme, a financial accelerator mechanism may operate through small firms that are financially more constrained after a contractionary monetary shock. On the other hand, the financial accelerator mechanism may operate through large firms that are financially more credit-constrained after an NBER recession shock. In both ways, a small adverse shock may be amplified through each credit-constrained firms, ultimately diminishing output in the economy.

Second, by examining the behavior of small and large firms by different periods, I find some empirical results that are consistent with previous research (earlier periods) and recent research (recent periods). During earlier periods, I find that small firms are

more sensitive in some of balance sheet variables to either a monetary policy shock or an NBER recession shock, which is in line with previous studies. In particular, small firms diminish their inventories, total short-term debt, and bank debt more than large firms to these two kinds of shocks. This finding suggests that small firms are more credit-constrained than large firms.[57] During recent periods, however, large firms are more sensitive in most balance sheet variables to either a monetary policy shock or an NBER recession shock, which support recent research. In particular, large firms are more responsive than small firms to both kinds of shocks in their sales, total short-term debt, short-term bank debt, mortgages, other debt, and trade debt.[58] After an NBER recession shock, large firms substantially decrease more than small firms in all of those variables. Yet, after a monetary policy shock, large firms show somewhat similar behavior with small firms in some variables such as bank debt and mortgages even if they are generally more sensitive than small firms.

One interesting result is that, after a monetary policy shock, *all* firms decrease their short-term debt during earlier periods, but they increase during recent periods. The evidence suggests that, after a monetary policy shock, firms' ability to raise short-term debt appears to have increased in recent periods. Furthermore, following a contractionary monetary policy shock, small firms *decrease* their short-term debt more than large firms during earlier periods; in contrast, large firms *increase* more than small firms during recent periods. Although those results seem to be contradictory, they are

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[57] However, for other variables such as mortgages, other debt, and trade debt, large firms decline more than small firms after either a monetary shock or an NBER recession shock.

[58] For bank loans, large firms are more sensitive to an NBER recession shock, whereas they exhibit very similar behavior with small firms to a monetary shock. For inventories, larger firms show very similar response with small firms to an NBER recession shock, but the sensitivity of firms is indistinguishable to a monetary shock.

consistent in that small firms continue to be more credit-constrained than large firms—at the time when demand for loans increases. For example, during earlier periods, small firms, which are credit-constrained more than large firm, experience more severe decline of short-term debt. Similarly, during recent periods, small firms financially constrained more may be able to obtain less short-term debt.

For the evidence described above, I propose some explanation of why large firms are more sensitive in their short-term borrowing either to monetary policy or an NBER recession shock. A monetary shock differently affects firms' short-term debt than an NBER recession shock does, depending on the *firms' financial conditions* which change over the business cycle. First, firms' financial conditions may be somewhat strong at a time when a tight monetary shock arises. This is because a monetary tightening usually occurs when the economy is strong. Thus, firms' demand for loans still increases when interest rates rise. During an expansion, if large firms have a stronger financial condition than small firms, large firms may be able to easily finance short-term debt more than small firms. Second, firms' financial conditions may be very weak at a time when an NBER recession shock arises. This is because, to the extent that firms tend to increase their leverage during an expansion, a gradually and increasingly tighter monetary policy adversely affects firms' financial conditions. If large firms are more leveraged than small firms—in fact, they are according to the QFR data—their financial condition might be more fragile than those of small firms to an adverse shock in the economy. After an NBER recession shock, large firms may experience more severe reduction of loans than small firms do due to their weaker financial conditions.

3.7 Appendices

3.7.1 Appendix A: Creating Time Series for the Small Firm Group[59]

The QFR provides the financial data on eight asset sizes, grouped by assets sizes: the asset of 1) less than $5 million, 2) $5 to $10 million, 3) $10 to $25 million, 4) $25 to 50 million, 5) $50 to $100 million, 6) $100 to $250 million, 7) $250 million to $1 billion, and 8) more than $1 billion. One difficulty in using the QFR data is that the size categories are constructed in nominal terms. Therefore, inflation causes firms to drift between categories. To control for the inflation drift, following Gertler and Gilchrist (1994), I define small firms as those at or below the 30th percentile in sale distribution and large firms as above the 30th percentile. The specific procedure I used is as follows.

1. Identify the "marginal size class" with respect to sales. When we are adding up the class sizes by starting with the smallest firm class, marginal size class is the final one that contains the 30th percentile of nominal sales for that period. I cumulate each increasingly larger firm class until I reach 30% of total sales. After that, I define the *upper bound* of small firms as the cumulated aggregation that includes the marginal size class, which is denoted by CU(γ)—i.e., γ = 30%. CU(γ) includes $\gamma+\omega^U$ percent of total sales—i.e., γ (30%) plus ω^U (the amount exceeding upper 30%) where $\omega^U > 0$.

2. At the same time, I define the *lower bound* of small firms as the cumulated aggregation that excludes the marginal size class, which is denoted by CL(γ). CL(γ) includes $\gamma-\omega^L$ percent of total sales—i.e., γ (30%) minus ω^L (the amount that falls short of 30%) where $\omega^L > 0$.

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[59] In this Appendix A, I only explain the procedures to create time series for small firms. To create time series for the large firms, a parallel approach is used to large firms.

3. Now, I identify the sale-based weight to separate small firms from the dataset. The weight in *upper bound*, CU(γ), is $\omega^L/(\omega^U+\omega^L)$ and the weight in *lower bound*, CL(γ), is $\omega^U/(\omega^U+\omega^L)$. For example, let γ =30, and assume that CU(γ) includes 31% of total sales and CL(γ) includes 27% of total sales; in this illustration, $\omega^U=1$ and $\omega^L=3$ [60] so that a weight of CU(γ) is 3/4 and a weight of CL(γ) is 1/4. By using this weighted average, we can assign the bigger weight to CU(γ) because it approaches to the 30% of total sales more closely than CL(γ) does.

4. Such sale-based weight can be applied to the growth rate of other series we examine—for example, inventories and short-term debts. In other words, we compute the growth rates of other series (i.e., inventories and short-term debts) in small firms as a weighted average of other series growth in CU(γ) and CL(γ). For instance, in the previous example, the growth rate of inventories for small firms is 3/4 * g + 1/4 * s, where g is the growth rate associated with CU(γ) of inventories and s is the growth rate associated with CL(γ) of inventories. Here, the basic idea is that we apply the sale-based weight to the other series in order to find the growth of other series in small firms.

5. We can get the initial value for small firms. The initial level for other series was taken to be a weighted average of their value in CU(γ) and CL(γ), where the weights are the same as those defined above.

6. Cumulate up to achieve the level series.

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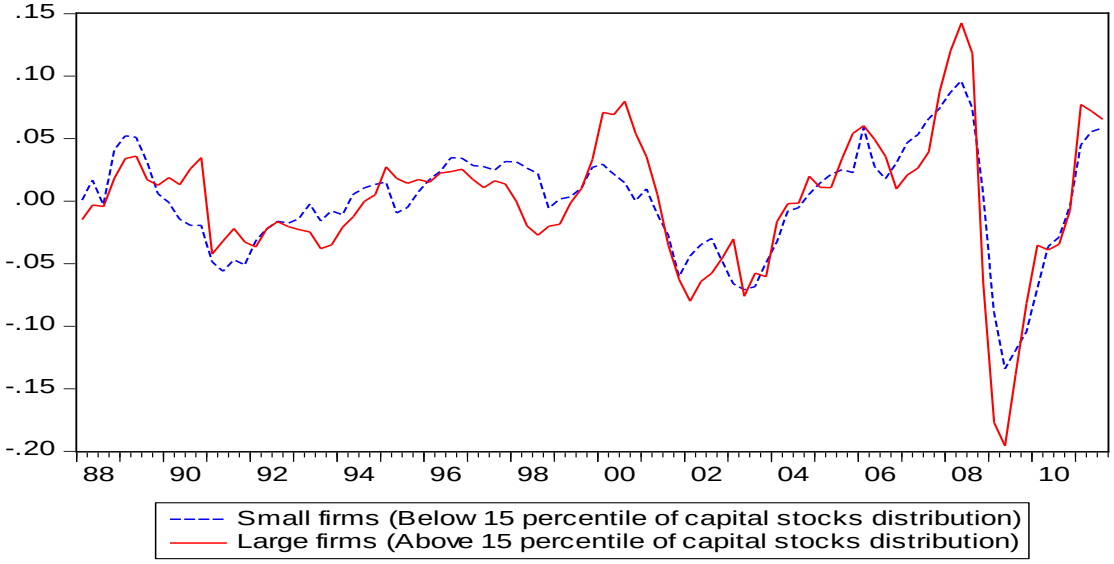
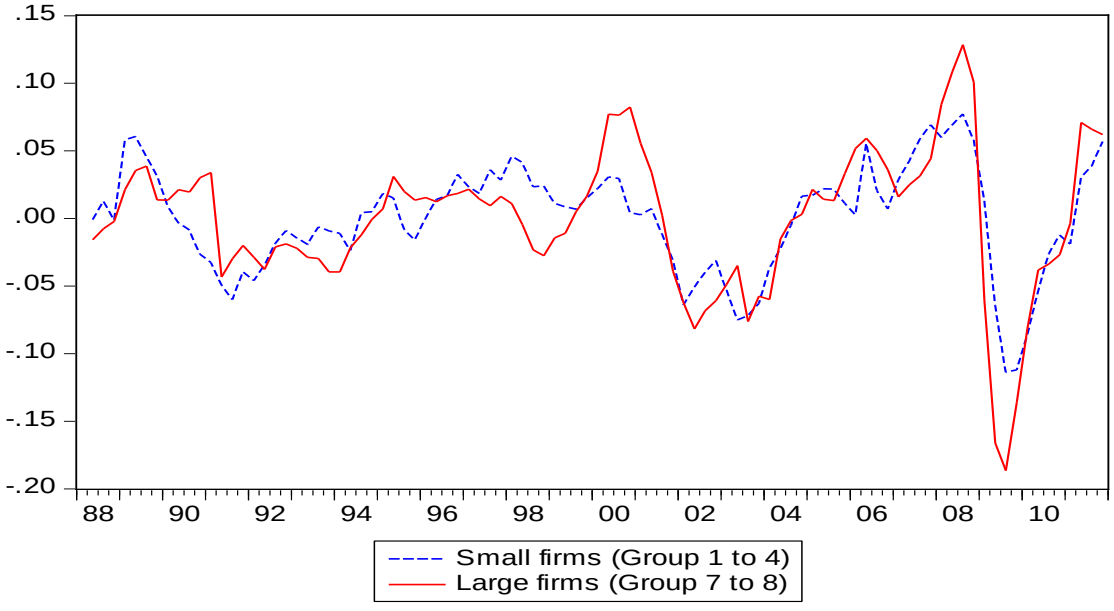
[60] The amount exceeding 30% in the upper bound is equal to 1, $\omega^U=1$ because $CU(\gamma)=\gamma+\omega^U$ (i.e., $31=30+\omega^U$); similarly, the amount falling short of 30% in the lower bound is equal to 3, $\omega^L=3$, because $CL(\gamma)=\gamma-\omega^L$ (i.e., $27=30-\omega^L$).

3.7.2 Appendix B: Cumulative Growth Rates of Sales after HP Filtering
(15th Percentile Capital-based Division and Nominal Cut-off Division)



Cumulative Growth Rates of Sales After HP Filtering
(15th Percentile Capital-based Division)

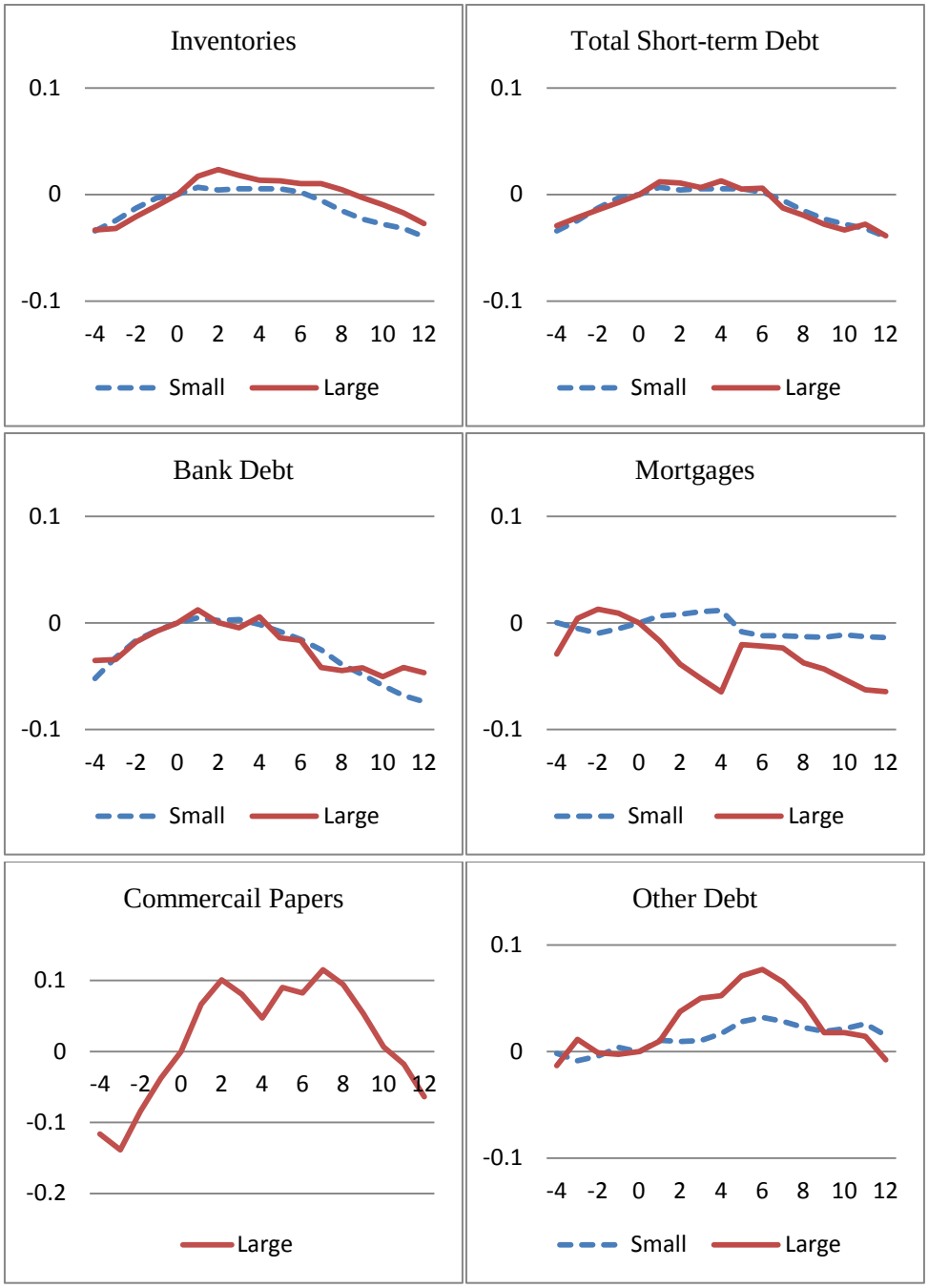


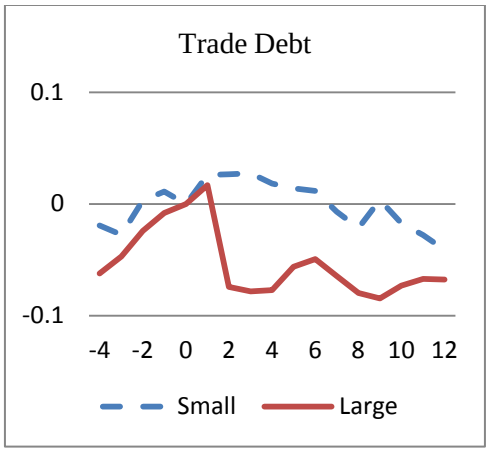
Cumulative Growth Rates of Sales After HP Filtering
(Nominal-cutoff Division)

Data Source: The Quarterly Finance Report

3.7.3 Appendix C: Average Changes in Inventories, Total Short-term Debt, Components of Aggregate Debt and Trade Debt Around Romer Dates

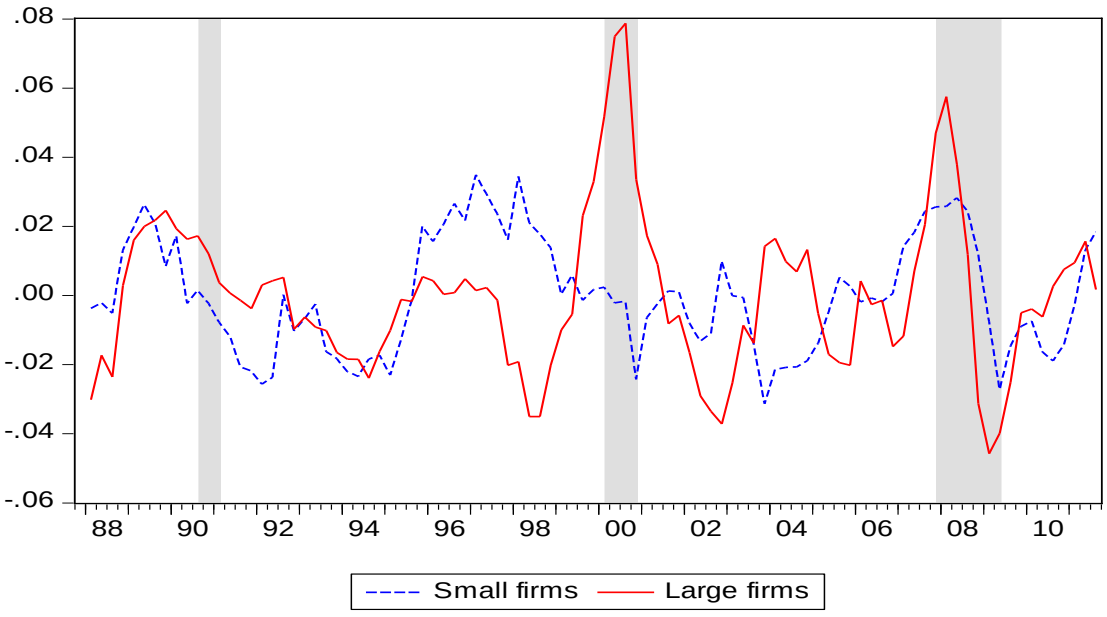
Flow of Fund Data (Earlier periods: 1960Q1−1989Q4)





Data Source: The Flow of Funds data

3.7.5 Appendix D: The Behavior of Net Worth Between Small and Large Firms Measured by Using the QFR Data



Cumulative Growth Rates of Net Worth after HP Filtering

Data Source: The Quarterly Finance Report

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CHAPTER 4

CONCLUSION

What are the mechanisms through which monetary policy influences the economy? How can the open market operations of only a few billion dollars have such large and persistent effects on aggregate spending? Can a small change in the federal funds rate make such a large difference for investment and consumption in interest sensitive sectors? The conventional interest-rate story had faced great difficulty in answering these questions because estimating the interest-rate effect alone was too moderate to explain such large impacts of monetary policy. Although a number of economists have searched for other possible explanations in part by considering the credit effects of monetary policy, they neglect the role of NBFIs in the credit-market analysis. Furthermore, in contrast to the view of the credit channel, which asserts that *small* firms are more adversely affected after tightening monetary policy (see Gertler & Gilchrist, 1991, 1993, 1994), recent research finds that *large* firms are more adversely affected after business cycle shocks in terms of employment, sales, and short-term debt. (see Moscarini & Postel-Vinay, 2008, 2009, 2012, for employment; see also Chari, Christiano & Kehoe, 2007; Kudlyak, Price & Sánchez, 2010, for sales and short-term debt) Such new findings raise questions about the roles of small and large firms during periods of tight credit.

My research addresses these issues by examining the behavior of lenders (i.e.,

financial firms) and borrowers (i.e., nonfinancial firms). Chapter 2 examined the lenders' side, the behavior of NBFIs, to answer the question of whether NBFIs behave in a similar way as banks after monetary tightening. Despite a substantially growing importance of NBFIs in the financial system, NBFIs are not treated in the monetary transmission mechanism because they are not subject to reserve requirement. However, to the extent that, like banks, NBFIs are well suited to deal with information problematic borrowers and provide credit to such borrowers, the credit effects asserted by the credit channel theory may extend to NBFIs. That is, tight monetary policy may reduce the willingness of the loan supply of NBFIs in the same way as banks if tight monetary policy worsens NBFIs' balance sheet conditions, which in turn constrain NBFIs' ability to raise funds. These possibilities are theoretically justified by the bank capital channel theme (Van den Heuvel, 2002, 2007) and adverse selection model (Stein, 1998). Under this reasoning, I empirically find that the net worth of banks and NBFIs declined in response to tight monetary policy; on top of that, banks and NBFIs all reduce the loan supply as well. These results suggest that the credit channel theme can reasonably extend to NBFIs; consequently, just like banks, NBFIs may contribute to the reduction of output in response to monetary tightening.

Chapter 3 examined the borrowers' side, especially the behavior of small and large firms to answer the question of whether a monetary policy shock is different from a business cycle shock. Does each different shock affect the behavior of small and large firms *differently*? Employing the post-1990 subsample data, the comparison of small and large firms' behaviors reveals the following two pieces of evidence: (1) following a tight monetary shock, the short-term debt of large firms *increases* more than that of

small firms; (2) following a business cycle shock, on the other hand, the short-term debt of large firms *decreases* more than that of small firms. Why do large firms show more sensitive behavior than small firms to each different shock? One possible explanation is linked to the borrowers' financial conditions over business cycles—particularly at a time when each different shock arises. If large firms have stronger financial conditions than small firms at a time when a tight monetary shock arises[1]—and there is good evidence to suggest that they do—the large firms' ability to obtain credit is greater than that of small firms. So, large firms may be able to increase short-term debt more than small firms. Therefore, the first evidence suggests that *small* firms are more credit constrained after a *monetary policy shock*. Likewise, if large firms have weaker financial conditions than small firms at a time when a business cycle shock arises, the large firms' ability to acquire credit is less than that of small firms. Therefore, the second bit of evidence suggests that *large* firms are more credit constrained after a *business cycle shock*. Taken together, the evidence presented here implies that following a monetary policy shock, *small* firms may play a special role in credit markets during tight credit conditions, whereas following a business cycle shock, *large* firms may play a unique role in credit markets during recessions.

My research contributes to the literature of monetary transmission mechanism mainly in the subsequent manner. First, just like banks, NBFIs reduce the net worth and the loan supply in response to contractionary monetary policy. This evidence suggests that NBFIs are one possible factor that leads to the substantial decline of output and that NBFIs provide a possible explanation for existing puzzles. Second, during the pre-1990

[1] Because the Fed is likely to conduct tight monetary policy when the economy grows too fast, the firms' demand for credit may still increase during expansion.

periods, following tight monetary policy, *small* firms decrease bank debt more than large firms, which is consistent with previous research. I confirm in part that during earlier periods, small firms are more credit constrained than large firms when the Federal Reserve policy tightens. During the post-1990s periods, however, following tight monetary policy, *large* firms increase short-term debt more than small firms, particularly when need for external funds may be increasing. This evidence suggests that small firms continue to be credit-constrained more than large firms; small firms keep bearing the brunt of credit crunches caused by tight monetary policy.[2]

In spite of my research contribution to the existing literature, my research does not resolve an identification problem—i.e., the issue of deciding whether the volume of credit reduction arises from the supply side or from the demand side. In other words, I interpret the results of this research in terms of the credit channel theory that stresses the *supply*-driven mechanism. In particular, I assume that tight monetary policy influences the *willingness* of loan supply of other private lenders as well as banks; the fall of the loan supply, in turn, reduces output through intermediary dependent borrowers (especially small firms). However, the same results can be interpreted by the conventional *demand*-driven mechanism. The observed fall of loans may reflect a decline of demand for credit rather than a decline of supply of credit. Disentangling the identification problem by incorporating NBFIs into the general framework would be an interesting area in future research.

In addition to disentanglement of the identification problem, there are some fruitful

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[2] A business cycle shock is different from a tight monetary shock in that a business cycle shock influences the behavior of *large* firms more adversely than small firms during the recession. As mentioned previously, in the post-1990 subsample, after a business cycle shock, large firms decrease their short-term debt more than small firms during recessions.

areas for future research. One promising research area is related to lines of credit, which have become more widely used as a source of firms' credit. It would be interesting to evaluate whether the small firm effect is closely tied to differential access to the lines of credit. As shown in Chapter 3, large firms increase their short-term debt more than small firms in response to contractionary monetary policy. Such sensitive behavior of large firms might be associated with the use and availability of credit lines. Another promising research area is associated with behavior of fund managers (such as mutual funds, pension funds, and hedge funds) in the monetary transmission mechanism. It also would be interesting to assess how monetary policy influences the behavior of funds managers and how their behavior influences ultimate output. As discussed in Chapter 2, over the postwar period, the assets of mutual funds and pension funds have grown very rapidly. There is a possible link between monetary policy and output through changes in the behavior of fund managers, if monetary policy can influence the behavior of fund managers. Although fund managers do not directly provide credit to firms, they can indirectly influence firms' investment decisions through changes in financial asset prices. Further researches in these areas may allow us to better understand monetary transmission mechanisms. They thereby inform us as to what policymakers should do to reduce large fluctuations of aggregate output and inflation.

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